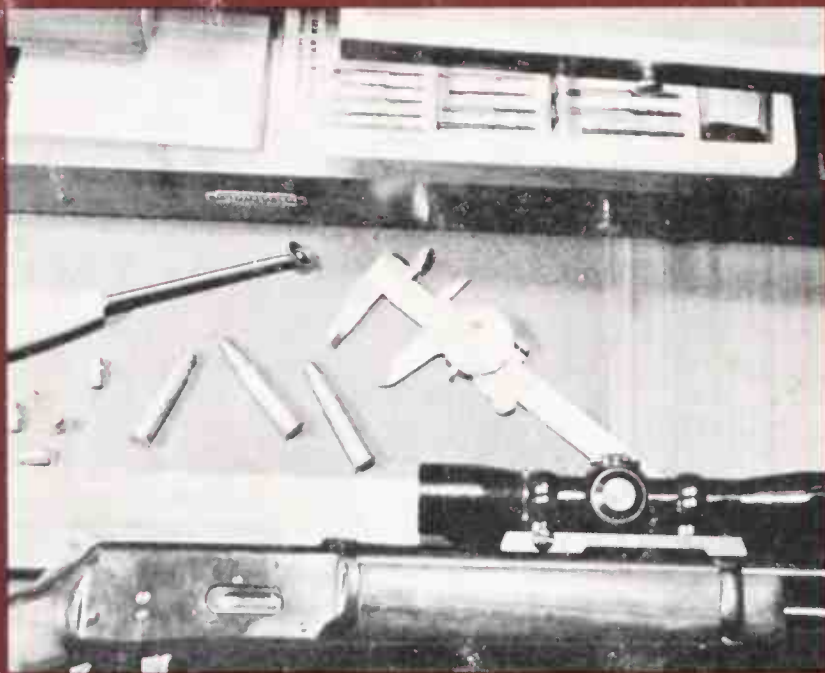


JOHN E. TRAISTER'S

# First Book of Gunsmithing

Beginner's guide to repairing and refinishing firearms



Learn how to:

- set up your own work bench complete with tools
- individualize your firearms by sighting scopes and adjusting triggers
- save money by doing repairs at home





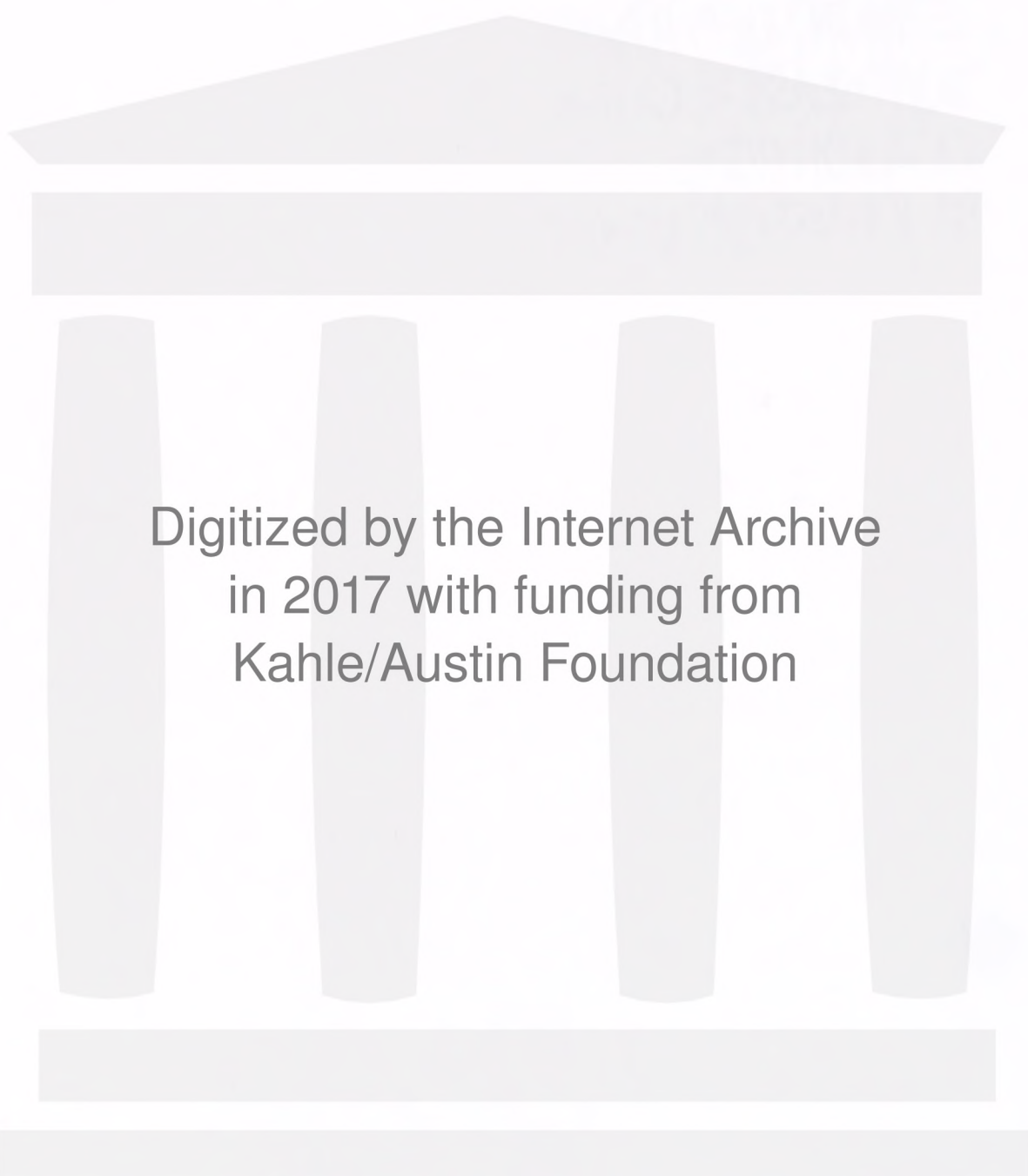
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# **FIRST BOOK OF GUNSMITHING**

John H. White





# **FIRST BOOK OF GUNSMITHING**

**John E. Traister**

**Stackpole Books**

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# Preface

EACH YEAR A growing number of individuals enter the fascinating field of gunsmithing. While some of these people make gunsmithing a full- or part-time business, most make it a hobby, tinkering with their own guns to keep them in first-class condition and have the pleasure of doing the work themselves. In doing so, these gun enthusiasts not only economize on the cost of repairs and alterations, but obtain a better working knowledge of firearms in general.

When first getting started, however, it is important to absorb the correct basic information. Taking your pride and joy apart without first knowing the basic techniques can be discouraging, if not downright disastrous. Getting a disassembled firearm back together is one of the most frequent problems encountered by amateur gunsmiths. They have very little trouble getting the gun apart, but putting it back together again is a different story.

Or if the wrong kind of screwdriver is used on tightly seated

screws, the screw slot will certainly be damaged, revealing that an amateur has tackled the job.

Then there are those who apply heat to a firearm say, to anneal a receiver for drilling and tapping for a telescope sight. If the job is not done precisely, it can lead to a forehead full of brass particles or a couple of missing fingers. And in some cases the result could be fatal.

Some gunsmithing jobs just are not suited for the home gunsmith. These require proper tools or greater mechanical ability and should be attempted only by a seasoned professional.

The chapters in this book are designed to start you out on the right foot—taking first things first—detailing what jobs should be performed by amateurs, and more important, what jobs should *not* be tried at home.

Detailed information will show you how to work on guns safely and also how to handle them safely in the field or on the range. You will learn how to care for firearms properly, insuring proper functioning, accuracy, and appearance for many years to come.

You will know where and how to set up a work area in the home, how to equip the shop, and how to use the tools to the best advantage. You will learn some of the time saving devices used by the pros, with detailed drawings and instructions to enable you to build your own.

The remaining chapters deal with specific repairs and alterations on firearms of all types. You will learn to mount sights, sight-in a rifle, refinish a badly abused firearm, stock a shotgun or rifle, decorate a stock with checkering designs, and many other useful projects. You will learn ways to improve the accuracy of a rifle or handgun, and when one malfunctions, you will know how to go about solving the problem.

Once you have decided upon a project, you will know where to buy the tools and materials from the various suppliers listed in the appendix.

With the knowledge derived from this book and with a little practice, you will be thinking and acting like a pro in no time. Not only will you gain a more complete understanding of firearms and their care, but you will also gain a better working knowledge of mechanical devices in general. You will learn to analyze all sorts of mechanical problems and will be able to do the work yourself. For



example, if you notice a faucet dripping, you will be able to determine why and make the repairs yourself—saving yourself money in repair bills.

Happy gunsmithing, and I certainly hope that you derive as much pleasure from this book as I have in writing it.

John E. Traister

1981



# **Introduction to Home Gunsmithing**

THERE HAS ALWAYS been a strong interest in home gunsmithing among gun cranks, whether shooter, hunter, collector, or any combination of the three. Today, as never before, this interest in gun repair is at its highest and continues to grow at a very rapid pace. Some reasons for this continued interest include an increase in leisure time, a rise in the number of firearms needing repair or adjustment, a lack of sufficient gun repairmen, and a desire for custom features on a firearm that, obtained elsewhere, cost a pretty penny.

Gun repair is not something that can be learned quickly by buying a few tools and then tearing a gun apart—although many people start out exactly this way. More often than not, the gun ends up being repaired by a professional gunsmith. The experience is so discouraging that it is a long time (if ever) before the amateur attempts to fix a gun again. These frustrations can be avoided (or at least cut to the bare minimum) by following the suggestions outlined in the following chapters.





Fig. 1-1. Firearms offer individuals fine sport, for both hunting and target practice. Note the ear protectors worn by the shooter.

## **SAFETY**

All firearms and ammunition components are potentially dangerous. To eliminate accidents, certain safety precautions must be observed, and everyone involved with firearms must be continually alert. There is no halfway mark. For this reason it is suggested that the rules of firearm safety be read and reread.

## **FEDERAL FIREARMS REGULATIONS**

There are certain firearm regulations that you should know before getting involved with gunsmithing that can save you much grief. In some cases, this grief has come in the form of ten years or more in prison for some otherwise innocent citizens who were unfortunate enough to get caught in a firearms violation. Don't let this happen to you. As long as these laws are on the books, abide by them.

In general, the law allows you to work on your own firearms any time you wish. But if you work on another person's guns, even just cleaning them, you must have a Federal Firearms License or else work for someone who has one. To qualify for the license, you must:



Fig. 1-2. If you were going to disassemble this Ruger Police Service-Six, would you know where to begin? Would you know how to assemble it again?

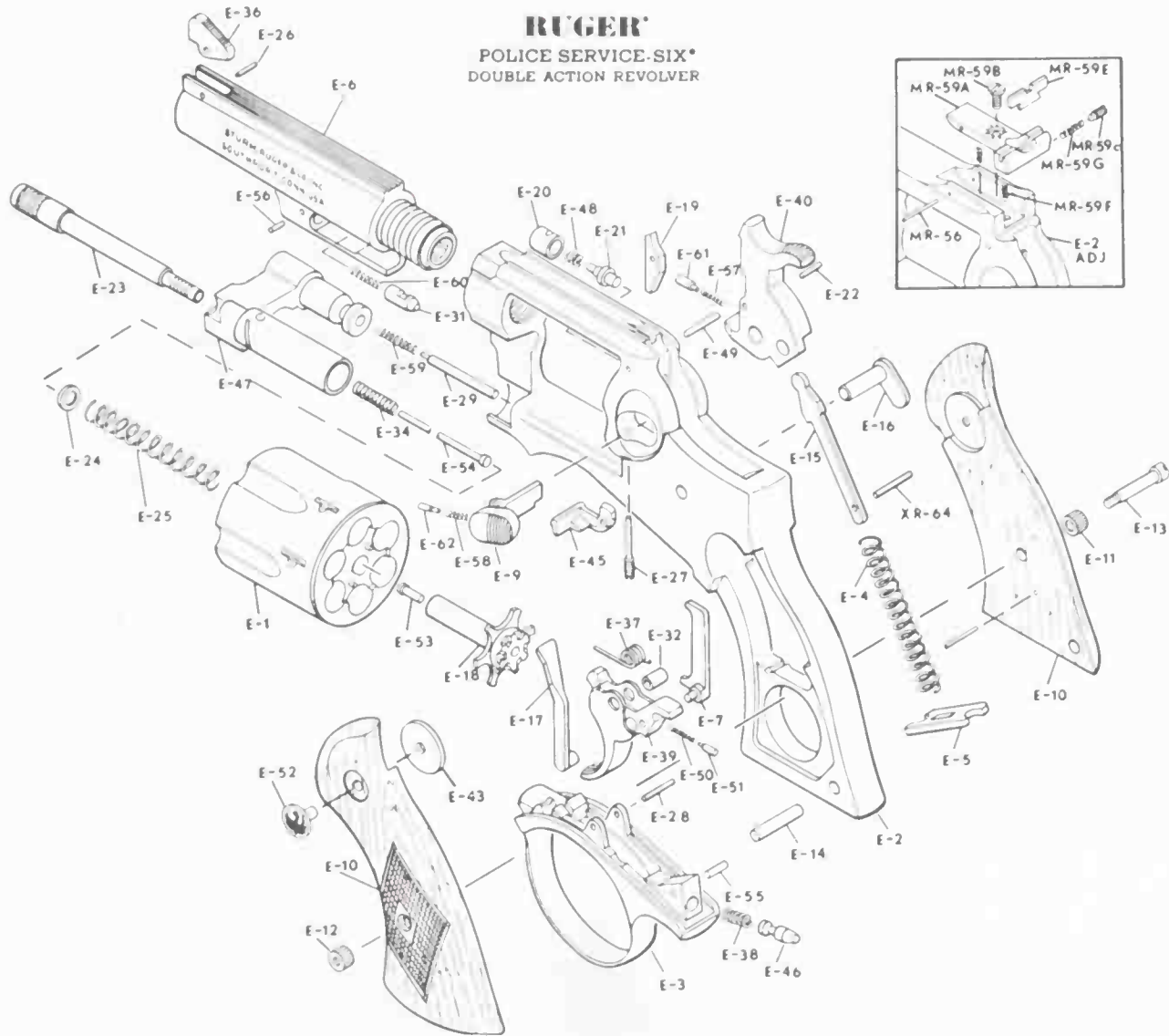


Fig.1-3. An exploded view of the Ruger Police Service-Six. Such drawings, available from the manufacturers for most modern firearms, are a great aid in disassembling and assembling firearms since they show the relationship of all parts.

DEPARTMENT OF THE TREASURY BUREAU OF ALCOHOL, TOBACCO AND FIREARMS <b>APPLICATION FOR LICENSE</b> UNDER 18 U.S.C. Chapter 44, FIREARMS		FOR ATF USE ONLY  	FOR INTERNAL REVENUE SERVICE CENTER USE ONLY					
1. NAME OF OWNER OR CORPORATION (If partnership, include name of each partner)								
2. TRADE OR BUSINESS NAME, IF ANY		3. EMPLOYER IDENTIFICATION NUMBER OR SOCIAL SECURITY NO.						
4. NAME OF COUNTY IN WHICH BUSINESS IS LOCATED		5. BUSINESS ADDRESS (RFD or street no., city, state, ZIP code)						
6. BUSINESS LOCATION (If no street address in item 5, show directions & distance from nearest P.O. or city limits)		7. TELEPHONE NUMBER (Include Area Code) BUSINESS _____ RESIDENCE _____						
8. APPLICANT'S BUSINESS IS <input type="checkbox"/> INDIVIDUALLY OWNED <input type="checkbox"/> A CORPORATION <input type="checkbox"/> A PARTNERSHIP <input type="checkbox"/> OTHER (Specify) _____		9. APPLICANT'S BUSINESS IS LOCATED IN <input type="checkbox"/> A COMMERCIAL BUILDING <input type="checkbox"/> A RESIDENCE (See instruction 4) <input type="checkbox"/> OTHER (Specify) _____						
10. IS ANY BUSINESS OTHER THAN THAT FOR WHICH THE LICENSE APPLICATION IS BEING MADE CONDUCTED ON THE BUSINESS PREMISES. (If "Yes" give the general nature of that business) <input type="checkbox"/> YES <input type="checkbox"/> NO		11. DATE APPLICANT DESIRES TO COMMENCE BUSINESS REQUIRING A LICENSE						
12. APPLICATION IS MADE FOR A LICENSE UNDER 18 U.S.C. CHAPTER 44 AS A (Place an (X) in column (b) of the appropriate line. Submit the fee shown in column (c) with the application.)								
TYPE OF LICENSE*								
a	X b	FEE c						
1 DEALER IN FIREARMS OTHER THAN DESTRUCTIVE DEVICES OR AMMUNITION FOR OTHER THAN DESTRUCTIVE DEVICES (INCLUDES Rifles, Shotguns, Pistols, Revolvers, Ammunition only. Gunsmith activities and National Firearms Act (NFA) Weapons)		\$10						
2 PAWNBROKER DEALING IN FIREARMS OTHER THAN DESTRUCTIVE DEVICES OR AMMUNITION FOR FIREARMS OTHER THAN DESTRUCTIVE DEVICES		\$25						
3 COLLECTOR OF CURIOS AND RELICS (Note: Omit items 14 and 15 if checked here and no other licenses are applied for.)		\$10						
6 MANUFACTURER OF AMMUNITION FOR FIREARMS OTHER THAN DESTRUCTIVE DEVICES		\$10						
7 MANUFACTURER OF FIREARMS OTHER THAN DESTRUCTIVE DEVICES		\$50						
8 IMPORTER OF FIREARMS OTHER THAN DESTRUCTIVE DEVICES OR AMMUNITION FOR FIREARMS OTHER THAN DESTRUCTIVE DEVICES		\$50						
9 DEALER IN DESTRUCTIVE DEVICES OR AMMUNITION FOR DESTRUCTIVE DEVICES		\$1000						
10 MANUFACTURER OF DESTRUCTIVE DEVICES OR AMMUNITION FOR DESTRUCTIVE DEVICES		\$1000						
11 IMPORTER OF DESTRUCTIVE DEVICES OR AMMUNITION FOR DESTRUCTIVE DEVICES		\$1000						
*Note: Applicants intending to engage in business relating to NFA weapons (including destructive devices and ammunition for destructive devices) are required to pay a special (occupational) tax before commencing business (26 USC 5801).								
13. PAYMENT FOR THE LICENSE, MADE PAYABLE TO THE INTERNAL REVENUE SERVICE, IS ATTACHED OR ENCLOSED IN THE FORM OF <input type="checkbox"/> CHECK <input type="checkbox"/> MONEY ORDER <input type="checkbox"/> OTHER (Specify) _____ AMOUNT SUBMITTED \$								
14. HOURS OF OPERATION OF APPLICANT'S BUSINESS			15. ARE THE APPLICANT'S BUSINESS PREMISES OPEN TO THE GENERAL PUBLIC DURING THESE HOURS?					
Time	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	<input type="checkbox"/> YES <input type="checkbox"/> NO (If no, give explanation on separate sheet.)
Open								
Close								
16. IS APPLICANT PRESENTLY ENGAGED IN A BUSINESS REQUIRING A FEDERAL FIREARMS LICENSE? (If yes, answer 17 to 21) <input type="checkbox"/> YES <input type="checkbox"/> NO								17. APPROXIMATELY HOW MANY FIREARMS WERE SOLD BY APPLICANT DURING PRECEDING TWELVE MONTHS
18. PRESENT LICENSE NUMBER								19. DATE FIREARM BUSINESS COMMENCED
IF BUSINESS OBTAINED FROM SOMEONE ELSE GIVE								
20. NAME								21. LICENSE NUMBER

ATF Form 7 (5310.12) (4-79) EDITION OF (4-78) MAY BE USED

SERVICE CENTER

**Fig. 1-4 Federal Firearms License Application.** If you will be using a name for your business other than your personal name, such as "Acme Gun Sales" or "Bonanza Guns," enter it in section 2. If you will be operating out of your garage, basement, or outbuilding, be specific and say so in section 9. For type of license—ammunition-making, collector of firearms, gun repair only, importer of firearms—check the appropriate line in section 12. State the hours you will be open, weekends included, in section 14. The back of the form is self-explanatory, but be sure to sign on the appropriate line.



ATF Form 7 (5310.12) (4-79)

1. Be twenty-one years of age or older
2. Not be under indictment for, or have been convicted of, a crime punishable by imprisonment for a term exceeding one year (not including business offenses or misdemeanors not involving a firearm or explosive that are punishable by a term of imprisonment for two years or less)

3. Not be a fugitive from justice
4. Not be an unlawful user of or addicted to marijuana or any depressant, stimulant, or narcotic drug
5. Not have been adjudicated as a mental defective or have been committed to a mental institution
6. Not be an alien
7. Not have renounced United States citizenship
8. Not have willfully failed to disclose any material information or made any false statement as to any material fact in connection with an application for a federal dealer's license
9. Have premises from which you conduct business or from which you intend to conduct a dealer's business within a reasonable period of time

Besides permitting you to work on firearms for others, this license also allows you to buy and sell firearms and ammunition at wholesale or retail to residents of your state. Depending on state laws, sales to residents of adjoining states may be permitted. The

Digit	Stands For
1	Alcohol, Tobacco and Firearms Region
2,3	Internal Revenue District
4,5,6	County of State where business is conducted
7,8	Type of license
9,10	Expiration Date Code
11-15	Sequence Number of License


  

1 Name		2 License Number		3 Expiration Date	
		5 75 057 02 H8 13981		Aug. 1, 1981	
5 Type of License 02		08 Importer of firearms other than destructive devices or ammunition for firearms other than destructive devices		09 Dealer in destructive devices or ammunition for destructive devices	
01 Dealer in firearms other than destructive devices or ammunition for firearms other than destructive devices		10 Manufacturer of destructive devices or ammunition for destructive devices		11 Importer of destructive devices or ammunition for destructive devices	
02 Pawnbroker dealing in firearms other than destructive devices or ammunition for firearms other than destructive devices					
03 Collector of curios and relics					
06 Manufacturer of ammunition for firearms other than destructive devices					
07 Manufacturer of firearms other than destructive devices					
4 Issued by Regional Regulatory Administrator ATF at Address					
Dallas, Texas					
6 Signature of Regional Regulatory Administrator					

ATF Form 8 (5310-11) (5-80) PART 1 EDITION of 5-78 MAY BE USED

**License (18 U.S.C. Chapter 44)**

In accordance with the provisions of Title 18, Gun Control Act of 1968 and the regulations issued thereunder (27 CFR Part 178), you are licensed to engage in the business specified in Item 5 of the license within the limitations of Chapter 44, Title 18, United States Code and the regulations issued thereunder, until the expiration date specified in Item 3 of this license. See **WARNING** on back.

 Department of the Treasury  
Bureau of Alcohol, Tobacco and Firearms

**Fig. 1-5.** Upon receipt of your Federal Firearms License, you can legally do gun repair work for others as well as deal in firearms. Have copies made of the Copy of License to send to all suppliers. The suppliers will then ship firearms directly to you at a trade discount.

business may be located in your home, a garage, an outbuilding, or a regular place of business, but must be open to the public during the hours you specify on your application.

To apply for a license, write to the Department of the Treasury: Bureau of Alcohol, Tobacco, and Firearms, addressed to your regional IRS, and request an application for license under U.S.C. Chapter 44, Firearms.

If you qualify, you will receive your license in approximately two months after mailing the completed application and fee. The original license should be displayed in your place of business. A copy of this license is also provided for your trade suppliers. Have several copies of this license made and send a signed copy to each supplier when placing an order. When requesting catalogs, also send a signed copy of this license, since most suppliers require proof that you are entitled to a trade discount.

Your license covers operations only at the location shown on the license. When it is time for renewal, the Bureau of Alcohol, Tobacco, and Firearms (ATF) will send a renewal application about sixty days before the expiration date shown on your license. If you do not receive a renewal application thirty days or so before the expiration date and you want to remain in business, notify the ATF regional office immediately.

FIREARMS ACQUISITION AND DISPOSITION RECORD									
DESCRIPTION OF FIREARM						RECEIPT		DISPOSITION	
MANUFACTURER AND MODEL	MODEL	SERIAL NUMBER	TYPE OF ACTION	CALIBER OR GAUGE	DATE	FROM WHOM RECEIVED (Name and Address)	DATE	TO WHOM	ADDRESS OF LICENSE NUMBER (Name and Address)
1) Ithaca	1021004	66071586	Pump	20	4/2/75	John's Fine Guns Inc. FFL # 42 987	11/20/76	James House	Form 4473 # 2
2) Smith & Wesson	10	410512	Revolver	.38	8/4/75	Swap Shop FFL # 46 3488	2/		
3) Western Field	10504	691467	Pump	20	8/6/75	John's Fine Guns Inc. FFL # 42 987	2/11/2/76	Jim Michaels	Form 4473 # 8F
4) Winchester	94	382906	Lever	10-20	11/4/75	Al Greenleaf Inc. 428 Portland St. FFL # 46 3488	9/1/76	Bill Brounce	Form 4473 # 50
5) Remington	870	4432	Pump	16	4/4/76	Tom Problem FFL # 46 3488	6/20/76	Forrest Mott 1 Inc.	FFL # 46 3488
6) Remington	540 X	3126884	Single	.22	1/2/76	John's Fine Guns Inc. FFL # 46 3488	7/14/76	Brian Smith	Form 4473 # 35
7) Browning	200	3P679	Auto	.45	8/2/76	John's Fine Guns Inc. FFL # 46 3488	7/1/77	John Doe	Form 4473 # 36
8) Western Field	10504	691467	Pump	20	7/2/76	John's Fine Guns Inc. FFL # 46 3488	12/2/76	Stolen - Reported to	Police on 12/4/76
9) Smith & Wesson	34-1	410562	Auto	.22	12/1/76	John's Fine Guns Inc. FFL # 46 3488	12/12/76	John Jones, Metro Police	See Certification in the serial # 4473
10) Remington	870	4432	Pump	16	12/2/76	John's Fine Guns Inc. FFL # 46 3488	12/2/76	Tom Problem	See Certification in the serial # 4473

Fig. 1-6. You must keep a Firearms Acquisition and Disposition Record of all firearms received for repair if they remain in your shop at the close of business on the day you receive them. Also keep a record of all firearms bought and sold through the business.



To renew your license, complete and send the application and fee to your local IRS before the expiration date. You may operate until your new license is received, even though the expiration date has passed.

Gunsmiths, like firearms dealers, must maintain a separate permanent record of all firearms received and disposed of, including firearms received for repair. They must be logged in and out, using a firearms acquisition and disposition record. A comprehensive book explaining what is required of a dealer and what records are necessary and how to prepare them will accompany your license.

# **Firearm Safety**

THOSE PEOPLE WHO understand the operating characteristics and potential dangers of firearms seldom have an accident. On the other hand, someone who is careless or does not understand firearms is a source of danger, to life and property. Remember that the basic purpose of a firearm is to kill, and that any firearm will perform this function extremely well. Therefore, everyone who handles a firearm should have complete control of it.

Even those who have used firearms for years are not immune to accidents. One careless moment can end in injury or death. Some years ago a Michigan resident had a classic pre-World War II Winchester Model 70 converted to a .270 Weatherby Magnum. The conversion was done expertly by Weatherby, Inc. The rifle further boasted a Pachmayr safety conversion to afford the mounting of a telescope sight and a Flaig trigger shoe. The rifle was fired several times and found to be exceptionally accurate and a pleasure to shoot.

However, one day the magazine was loaded with three rounds and firing commenced at a target 100 yards downrange. The first two rounds went off smoothly, and by viewing through the spotting scope, it was evident that both holes in the target were just about touching each other. The third round was fed into the chamber, but when the trigger was squeezed, only the snap of the firing pin was heard—there was no report from the fired cartridge. Thinking that he had either not chambered the round or that the cartridge was defective, the shooter opened the bolt and started to pull it towards the rear. After pulling the bolt backward only about a half inch, a violent explosion occurred, driving hot gas and brass particles back toward the shooter. The shooter's eye was saved, but dozens of brass particles were removed from his face.

Upon examining the gun, it was discovered that the extractor had been blown completely off, and the floor plate was bowed in a U shape. The telescope was also damaged beyond repair. Since then, the gun has been repaired and is now back in service.

This accident was caused by a phenomenon known as a *hangfire*, a potentially dangerous situation when what appears to be a misfire discharges after a short delay. Hangfires are usually caused when the blow to the firing pin is too light or when the cartridge has become wet or the primer is oil-laden. So anytime a cartridge does not fire immediately when struck by the firing pin, keep the gun pointed down range and wait at least ten seconds before opening the bolt or breech block to examine the cartridge. The shooter in the example opened the action too soon, and the cartridge discharged after he had unlocked the bolt causing the cartridge head to disintegrate. He actually knew better, but one careless moment nearly cost him his eye.

More recently, a Virginia school superintendent ended a day of deer hunting by pumping all the rounds (or so he thought) out of his Winchester Model 94 rifle, chambered for .30-30. He propped the rifle against the side of his truck while he unlocked the truck door. When the door was opened, the rifle fell over, and the hammer struck an object on the ground causing the rifle to discharge. The 170-grain bullet entered just below his rib cage, followed his rib cage upward, and emerged at the base of his neck—without hitting any vital organs!

Several safety points can be learned from this story. Do not rely



on “count” or “feel” when unloading a rifle. Visually inspect the action and chamber to be sure that no cartridges are left in the gun. With hammer guns, like the Winchester Model 94, always leave the hammer at half cock so if an object should hit the hammer it won’t accidentally discharge the round in the chamber. Finally, it is better to lay a gun flat on the ground rather than prop it in an unstable position. More accidents have probably occurred because of this than any other type of mistake.

Never point a firearm at anything or anyone you do not intend to hit. This applies to loaded as well as unloaded guns. Make sure your firearm is in good operating condition, use the proper ammunition, and see that no obstructions, such as a cleaning brush or heavy grease, are in the chamber or bore.

A device that is often overrated is the gun’s safety mechanism. Designed to prevent the gun from firing if the trigger is accidentally depressed, it is there purely as a safety feature, but in no way does it, nor is it intended to, take the place of standard safety procedures. Some guns have discharged without ever having the trigger pulled and with the safety in the “safe” mode. This occurs especially when trigger mechanisms have been tampered with, for example to lighten the trigger pull. In such cases, a medium-hard knock on the butt end of the stock can, and will, discharge a weapon with a “hair” trigger pull. Also remember that no gun part, no matter how finely manufactured, is perfect. Any portion of the gun’s mechanism can fail at any time. For this reason, a gun should never be pointed toward people or property. A gun with a defective safety should be repaired at once—certainly before the gun is used.

Hunting situations and field usage of firearms probably present the most hazardous conditions as far as human safety is concerned. This is especially true when shooters take to the field in groups of two or more—the usual situation. Many otherwise knowledgeable and experienced shooters fail miserably when it comes to the simple act of properly carrying a gun. In general, a gun should be pointed straight up or down at all times until you are ready to fire. Any other position could result in the muzzle pointing toward another hunter if a sudden turn is made. Carrying a firearm improperly puts every other person in the field in danger.

Be aware of the ultimate backdrop with every shot fired, in every direction where a shot *might* be fired. The ultimate backdrop

is an area where the bullet is certain to strike, even if it misses or passes through the original target. While many shooters believe that firing a rifle up in the air eliminates all possible danger, nothing could be further from the truth. A bullet has a path of flight similar to a rock, arching upward and then downward as gravity takes over. When a bullet is fired into the air, it must come down some place. A few years ago a young lad was shooting walnuts off trees in the backyard of his rural home. One of the bullets descended three quarters of a mile away through a kitchen window, hitting a baby in the face. Although the baby was not seriously injured, she will carry a scar the rest of her life.

In another incident, the son of a local attorney was playing in his backyard on the outskirts of Luray, Virginia when he experienced what felt like a bee sting on his shoulder. His mother, noticing the wound, took him to the hospital where a doctor found a .22 rim-fire bullet lodged in the boy's shoulder. The shooter was never discovered, but it was assumed that someone shooting nearby did not use a proper backstop for the bullets.

At this point, it might seem that the use of a firearm is a most complicated process. This is absolutely true. Fortunately, with practice and experience, safety precautions and requirements become almost instinctive. Just as the aiming process becomes second nature after many months of practice, so does the process of securing all loose ends when it comes to firearm safety.

While accuracy and proper shooting techniques often improve with experience, some shooters become lax regarding safety measures after the same amount of experience. Shooters become proficient at safety techniques when first learning, but after a fair degree of overall efficiency has been obtained, too many of them feel they know so much about shooting that they can disregard many safety precautions. This is how most accidents and deaths occur. Any gun is like a well-trained guard dog. When handled properly, it will perform the functions it is designed for. But get careless, and it will bite you sooner or later.

Safety training, like all learning experiences, must be ongoing, or stagnation occurs. The shooter then becomes an accident waiting to happen. There is absolutely no need for this to occur. Do not wait for an unfortunate accident to wake you up to the very real hazards of firearms.

Following are some of the basic safety rules that everyone should observe.

*Treat every gun as if it were loaded at all times.* When handling any gun, keep the finger away from the trigger, and point the muzzle in a safe direction until the action is opened and the chamber and magazine have been visually inspected to make sure they are empty. Get in this habit every time you pick up a gun—even one in your house or gun cabinet—that you are certain is unloaded.

*Inspect all guns before firing.* Before firing, check the bore for obstructions and remove them if any are found (this includes heavy grease). Never try to fire out obstructions. A friend stumbled during a quail hunt and rammed the muzzle of his Winchester Model 21 side-by-side double shotgun into a mud bank. Moments later, on his first shot at a covey of quail, about 6 inches of barrel, from the muzzle back towards the breech, disappeared from his \$3,000 shotgun!

*Be careful of gun conversions.* Be sure of the safe working pressures of an action before rechambering and/or rebarreling it to another cartridge. For example, the .30-40 Krag action is designed for pressures around 42,000 psi. A conversion to .30-40 Improved Krag could be dangerous.

*Beware of handmade parts.* Just because a metal part is made to the exact same dimensions of an existing gun part does not mean it is safe. Most gun parts must be heat-treated to withstand certain pressures, so be careful when making replacement parts, or you will damage the gun as well as yourself.

*Attempt jobs only within your capabilities.* Make sure you know what you are doing before attempting any major gun work. If you are not sure about a problem, seek professional advice.

*Check trigger pulls.* Hair triggers have no place on hunting arms. Guns with hair triggers can discharge with only moderate pressure on the gun butt. Experienced shooters will tell you that smoothness is more important for accuracy than lightness. In most cases, a three-and-one-half-pound trigger pull should be minimum.

*Beware of old shotgun barrels.* Old shotgun barrels with short chambers can cause excessive breech pressure and might be dangerous to fire. Of course, only black powder loads (or no loads) should be fired in shotguns with Damascus barrels.

*Test head spacing.* A rifle with excessive head space can be dangerous. Make a habit of testing older rifles before firing them—especially old military weapons.

*Test-fire in a frame, not your hands.* Doubtful guns should be fired first in a sturdy frame in case they explode. Then check for weak places.

*Never use live ammunition when working on guns in the shop.* Use dummy rounds when testing the feeding mechanism of a gun in the shop. They can be purchased, or make your own by resizing fired cases and inserting a bullet to the proper overall length. Then simply leave out the primer and the powder.

*Do not remove too much metal from stress points.* This includes drilling screw holes in barrels for mounting sights. Many barrels have blown apart because the screw holes were drilled too deeply, unnecessarily weakening the gun.

*Use moderate heat.* Heat is sometimes necessary to silver-solder front sight ramps on barrels, or to anneal hard actions so that scope-mounting holes can be drilled. Be extremely careful, especially when applying heat on or near the locking system of a gun. If the metal finish on a weapon starts to discolor, you have probably applied too high a heat.

The best overall way to be safe is to think about safety at all times while using a firearm. If you train yourself to think constantly about safety from the beginning, it will eventually become second nature. You will automatically take the precautions that handling firearms requires. Without thinking, you will never point the muzzle of a gun in the direction of another person, or in such a way as to endanger pets, livestock, or property.



# **Cleaning and Maintenance of Firearms**

THE CLEANING OF a firearm at regular intervals takes only a few minutes and insures accuracy, good working order, and a long-lasting gun finish. On the other hand, a neglected firearm will be difficult to clean and will often be badly pitted—sometimes beyond repair. Therefore, if shooters keep their guns in first-class condition at all times, they can be expect them to function properly and last several lifetimes.

Weapons should be cleaned as soon as possible after they are used. But don't put the job off any longer than necessary because the chances of rust forming increase with time. A pitted bore can render a shotgun or rifle useless.

All that is required to clean a firearm is one of the basic cleaning kits available on the market. These kits contain a cleaning rod, rod tips, oil, powder solvent, and gun patches. Some include a wire brush. These kits are compact and easily transported to the field for clean-



Fig. 3-1. Any of the commercial cleaning kits will keep firearms in good working order when used correctly and at frequent intervals.

ing weapons immediately after a hunt or while on the range.

To use the cleaning kit, soak a gun patch in powder solvent (bore cleaner) and push the patch through the slotted tip attached to the end of the cleaning rod. Insert the tip into the barrel from the breech end, if possible, and run the patch the full length of the barrel and return. Repeat this operation as many times as necessary, usually fifteen or twenty times. Then use a dry patch to dry the bore. Change patches often until the last one comes out clean and dry. Finish the bore cleaning by lightly oiling a clean patch and running it up and back through the bore.

Extra-dirty bores require the use of a bronze bristle brush. Soak a clean patch with powder solvent (bore cleaner). Push the patch through the slotted tip of the cleaning rod and run it up and down the bore until the bore is saturated with the cleaner. Remove the slotted patch tip from the cleaning rod, insert the brush, and dip it into the powder solvent. Then push the brush up and down the bore about a dozen times to loosen the dirt and grime. Finish by drying the bore with clean patches until the last patch comes out clean and dry.

The outside of the gun should be wiped off with a silicone cloth to prevent rust and corrosion and also remove finger prints and eliminate salt spray damage. This cloth may also be used on the gunstock.





Fig. 3-2. The Brownell M-16 Cleaning Brush has dual heads with notched toothbrush-type bristles on the big end and a single row of short bristles on the small end for getting to hard-to-reach places.

The receivers of autoloading, pump, and lever-action firearms collect all sorts of debris and foreign matter and must be cleaned periodically to insure proper functioning. An old toothbrush or a Brownell M-16 cleaning brush can be used to get into actions and other hard-to-reach places. A squirt or two of WD-40 (a standard cleaner) sprayed into the action, followed by a good scrubbing with the brush will do wonders to keep actions clean and in first-class operating condition.

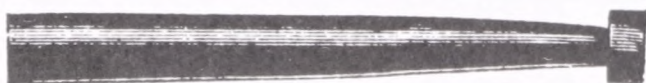
The frequency of the cleaning will vary with the use of the guns and the weather to which they are subjected. A good rule of thumb is to clean them after each firing. Also, when a gun is used or stored near salt water or in humid areas, it should be cleaned, or at least wiped off, every few days.

When cared for as described, guns will rarely be injured from rust, fouling, or corrosion from routine handling by human hands.

## GUN CLEANING ACCESSORIES

Of the various types of cleaning tips, the single-slotted tip is the most popular. Its advantage is that it holds onto a patch under all conditions. On the disadvantage side, sometimes the patch jams when reversed inside the bore, and often the cleaning action is one-sided, permitting the bare sides of the tip to rub against the rifling and perhaps cause damage after a time. The patch used with single-slotted tips should be large enough to require about 4 pounds of pressure to force it through the bore of the rifle.

The roll jag tip permits rolled or wrapped patches and is the type preferred by many shooters for cleaning rifles, such as lever-

**SINGLE SLOTTED  
TIP****FLEXIBLE JAG****PLAIN JAG****ROLL JAG****BRASS BRUSH**

**Fig. 3-3.** Several types of tips used for cleaning rifle, handgun, and shotgun bores.



actions and semiautomatics, that have to be wiped out from the muzzle end. The rolled patch bears against the rifling equally and does not have to be dragged into the bore. Accordingly, the rifling is preserved instead of being worn away in a vital spot.

Plain jag tips give a uniform cleaning action and reverse perfectly inside the barrel. The patch sticks to the tip as long as it is inside the barrel, but any movement beyond the muzzle or chamber will cause the patch to come loose. A pointed jag tip has the advantage of centering the patch before being inserted into the bore.

Many shooters prefer to use flexible jag tips, especially for cleaning shotgun barrels. A patch is slipped into the slot of the jag and wrapped around it. The slot, which imparts a measure of flexibility, causes the patch to press evenly on the bore thereby squeezing the oil into the pores of the steel. The slot also permits the cleaning patch to be compressed by the choke, insuring a thorough cleaning of the bore throughout its entire length. This jag is also good for holding steel wool and crocus cloth for polishing shotgun bores.

Wool and cotton mop tips are fine for oiling the bores of shotguns but must be kept clean as damage may result by the fouling of the wool, which will neutralize the preserving powers of the oil.

The leather shotgun bore polisher is made up of several buff leather discs that absorb polishing material, such as Clover abrasive compound, and aid in repolishing the bores of shotguns that have been neglected. Since no metal touches the bore, they can be used without fear of damage, even on more expensive weapons. Just be careful not to polish too much around the muzzle end of the shotgun because a change in choke pattern could result.

No attempt should be made to polish rifle barrels as the rifling will surely be damaged, causing the barrel to be inaccurate and worthless. Rifle barrels can sometimes be restored by lapping, but this is a job for the experienced gunsmith and is not recommended for the amateur (see chapter 14).

Most of the cleaning rods on the market today are made of aluminum, even though this soft metal picks up bits of dirt, which may have an abrasive effect on the bore. If possible, try to find a brass or wooden cleaning rod to fit your rifle or shotgun.

The cleaning rods used on rifled barrels should have a swivel joint so that the patch will rotate inside the bore as the patch is being run back and forth, following the twist of the rifling. Without

this rotation, the patch will drag at right angles across the lands and will destroy the sharp edges of the rifling, impairing accuracy.

A shotgun cleaning rod does not require a swivel joint because there is no rifling in a shotgun. Many experienced shooters prefer to use a high-quality, all-wood cleaning rod on shotguns. In most cases, these are made from prime, well-seasoned hickory wood. All woods do not make suitable shotgun cleaning rods, nor is kiln-dry wood satisfactory as it tends to be too brittle. For this reason, the hickory used for better rods is air dried to prevent warpage and insure the finish quality.

## METAL FOULING

Metal fouling is not too common, except in the small-caliber high-velocity rifles, but when it does occur, you should know how to handle it. When the fouling of metal is caused by jacketed bullets, the term *metal fouling* is used. However, when caused by lead bullets, it is called *leading*.

A rifle barrel that is smooth and well cared for will seldom have any problems with metal fouling. On the other hand, a neglected barrel will always develop metal fouling to some extent.

Regardless of the cause, metal fouling can disrupt accuracy. Examine the bore with a bore light. Any fouling will be visible as long streaks, flaky deposits, or lumps of metal particles sticking to the lands and grooves of the barrel.

To correct metal fouling, many shooters use a solution of ammonium persulfate, ammonium carbonate, stronger ammonia, and distilled water. However, this solution will damage the gun's finish if allowed to come in contact with it (which is easy to do since the solution is poured into the bore and allowed to soak for a period of time). Consequently, it is not a recommended procedure for the amateur. Instead, purchase a quantity of J-B Non-Imbedding Bore Cleaning Compound. Besides removing lead, metal, and powder fouling from rifles, pistols, and shotguns, it is guaranteed to improve the accuracy of your present firearm. It will not injure the finest bore and will also help guard against rust. Another commercial solution that is highly recommended for removing all traces of rust, leading, and fouling is G66 Brand Gun Treatment.



Fig. 3-4. The Decker Shooting Vise simplifies the task of holding a firearm for cleaning. It also has many other uses around the gun shop.

## HOLDING GUNS FOR CLEANING

Firearms can be held for cleaning in a conventional bench vise as long as padded vise jaws are used to protect the finish. Furthermore, guard against tightening the vise jaws too much as you can bend receivers and damage other parts. When using a bench vise, clamp the firearm into the vise in a horizontal position with the butt resting on the bench top. You then will have access to the bore for pushing a cleaning rod through it. Some shooters prefer to clamp the rifle or shotgun in a vertical position with the butt resting on the floor directly under the vise.

For very little expense you can build a suitable gun-cleaning rack similar to the wooden cleaning racks made available at one time to all military recruits. These were merely notched, wooden frames that held rifles securely while they were being cleaned. A commercial shooting vise, such as the Decker Shooting Vise, is reasonably priced and greatly simplifies the operation of gun cleaning. When used properly, all scratching and marring are eliminated because the Naugahyde covering over the sponge padding is all that



comes in contact with the gun. The base can be permanently mounted to a workbench or secured with C-clamps. This vise can also be used when sighting bores, mounting scopes, and zeroing rifles.

## COMPLETE GUN CLEANING

The procedures described previously are fine for day-to-day cleaning of firearms, but once or twice a year (more frequently when the gun is used in adverse weather conditions) the gun should be completely disassembled and given a thorough cleaning. Complete cleanings will help to eliminate malfunctions that continually occur due to a buildup of sediment in the action of semiautomatics and other repeating rifles and shotguns.

Brownell's d'SOLVE Gunsmith Cleaning is an excellent solution for complete firearm cleaning. It is fast, efficient, nonhazardous, nonflammable, odor-free, and inexpensive—just the thing for the home gunsmith. Available in one-gallon containers, which makes five gallons of bench cleaner, it can be mixed stronger for tough jobs and diluted for less demanding cleaning operations.

It is simplest to use a clean, plastic blueing tank such as those supplied by Birchwood Casey. If one of these is not available, buy a 4-foot length of 4-inch PVC (plastic) pipe, an end cap and some jointing compound from your local plumbing supplier. Cap one end of the PVC (plastic) pipe and set it in a vertical position. Filled with the cleaning solution, the gun parts can be dipped into it and allowed to soak while you do other jobs around the shop. The grimmest parts will come out clean, ready to dry, oil, and assemble.

When used as a brush-on cleaner, the cleaning solution rapidly rids actions and chambers of crusted dirt and grime. Some cleaner on a toothbrush will clean old checkering, and a small amount on a pad wiped across a gunstock will remove grime. If the gun is going to be soaked, remove all wood first.

If you have compressed air available, use it to blow loose grime from the gun immediately after it is lifted out of the tank. Set the pressure at about 50 psi and let it do the work for you. Compressed air is also excellent for drying wet gun parts.

## REMOVING RUST

One of the most difficult problems confronting gun owners is

how to remove rust from firearms without damaging the blueing. Light rust can be removed quite easily with WD-40, but heavy rust is another story.

The first attempt should be made with a rough bath towel coated with WD-40. Rub the rusted area vigorously for as long as necessary to remove all rust. If the blueing comes off with this method, it probably was not good anyway and the firearm should be reblued. In fact, this is probably the reason the gun rusted in the first place.

When a lot of rust is present, use No. 0000 steel wool dampened with WD-40 or G66 Gun Cleaner. Rub the rusted area lightly until all rust is removed. There is also a product available from Brookstone, Peterborough, NH 03458 called Brookstone Ruster Remover. You just add water for the concentration that best suits the job. The eight-ounce container makes up to five quarts of rust remover, which will last a long time.

For badly rusted parts, mix a highly concentrated solution of Brookstone Ruster Remover and soak the parts in it for as long as necessary to remove the rust. However, expect the blueing to be removed also. You will then have to refinish the metal by one of the methods described in chapter 12.

## **VISUAL INSPECTION DURING CLEANING**

While giving your firearms a thorough cleaning, carefully examine all parts within the gun for wear. This can save much disappointment later when you are using the gun in the field. Once all parts are thoroughly clean, examine the bore with a bore light. Is the barrel pitted? Should it be lapped? What is the general condition of the rifling, shotgun bore, and other parts? Examine each smaller part under a magnifying glass. Look for hairline cracks and excessive wear. If any are found, now is the time to replace or repair the part—not when you have lined up a big trophy animal in your sights and the gun fails. At the same time, check the condition of the gun's finish and decide if any parts should be touched up.

## **GUNSTOCK CONDITIONING**

During normal use, your gunstock will be subjected to scratches from briars, barbed wire fences, and other sharp objects, not to mention dents and perspiration stains. Of course, you should avoid any of these, but if a firearm is put to work in the field, you can expect

one or all of these problems to occur, and you should know how to deal with them properly.

When a gunstock shows signs of wear, the first thought is to refinish the stock. However, there are times where it is neither desirable nor feasible to completely refinish a worn gunstock. For instance, a gun that has collector's value loses some of its value if the old finish is tampered with.

For rejuvenating stocks, Patina Rub, available from Brookstone, Peterborough, NH 03458, is ideal for use on abused gunstocks. It is a combination of fine pumice, mineral oil, dryers, and alcohol that imparts a special patina to wood finishes. In only minutes, a badly scratched and stained gunstock can look almost like new by dipping a felt pad in the solution and rubbing the stock with moderate pressure in straight strokes with the grain. Be careful, and check your work frequently to avoid cutting through the existing stock finish.

Minor dents in gunstocks can be raised without necessitating the complete refinishing of the gunstock. One method is to wet an old washcloth, place it over the dent, and apply a hot soldering iron or regular household iron momentarily on the wet rag at the exact location of the dent. Do not leave the soldering iron tip on long enough to burn or cause the stock finish to bubble. Leave it there just long enough to cause the steam generated from the heat to swell the wood fibers and raise them to the surface. Repeat the operation as often as necessary until the dent is raised.

Larger dents and cracks in gunstocks must be dealt with another way. They may be filled with shellac sticks available from Brownells, Incorporated or Frank Mittermeier. These shellac sticks come in an assortment of colors to match the finish on your particular stock.

To use shellac sticks, heat a small spatula, no wider than  $\frac{3}{4}$  inch and no longer than 4 inches, in the flame of a torch until it is hot enough that, when pressed against the end of the shellac stick, it melts the shellac. When a small quantity of melted shellac accumulates on the end of the spatula, quickly wipe it across the area of the stock to be repaired. It is easiest if the spatula blade is turned so the melted shellac is on the bottom of the blade. Hold the blade at a 45-degree angle as it is drawn over the scratch. If the first pass does not completely fill the crack, repeat until it does. If you are extremely careful—and it does take skill—you can fill a dent or crack without damaging the existing finish. After the shellac has



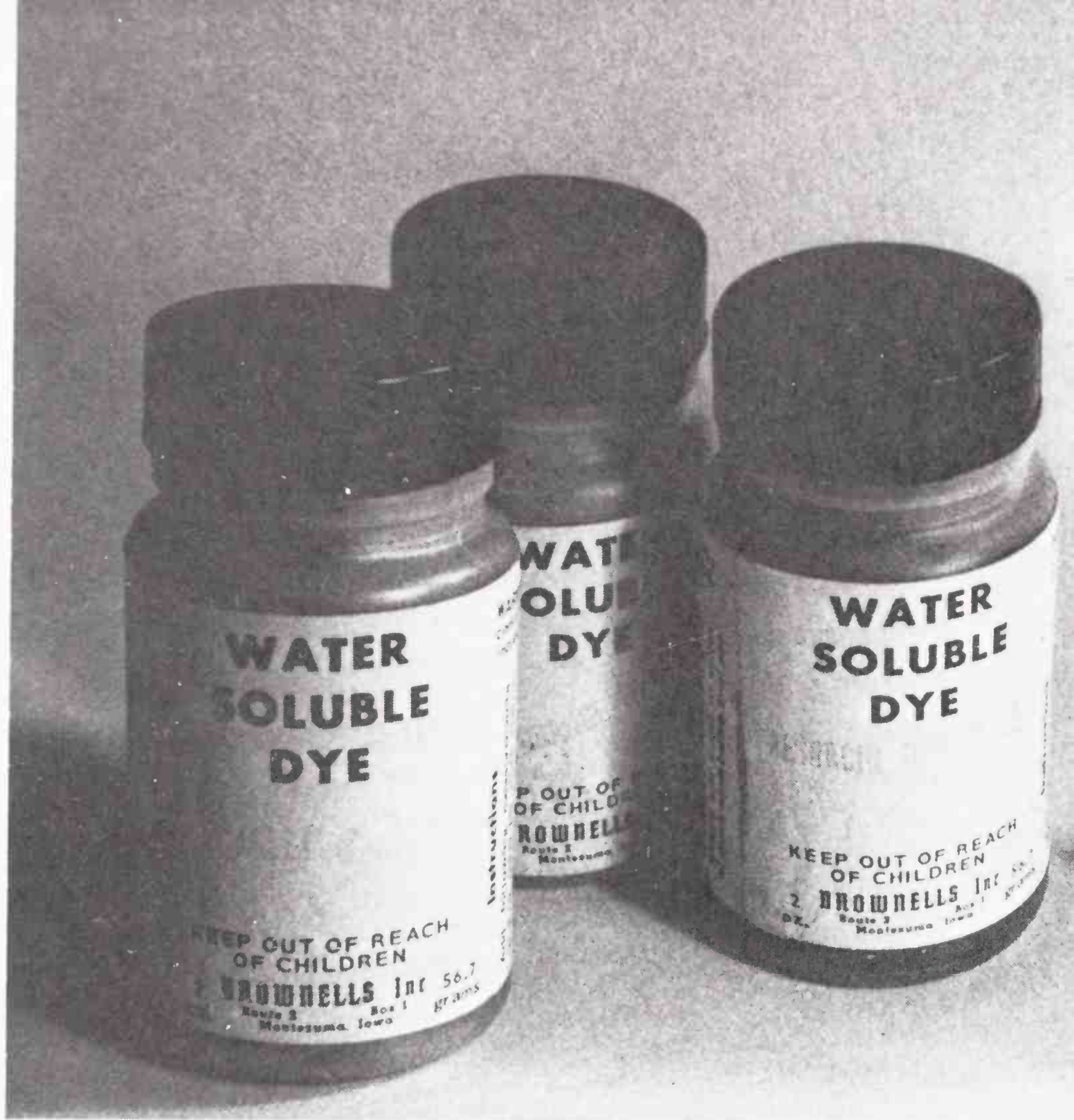


Fig. 3-5. Brownell's Water Soluble Dyes produce clear colors without covering the natural beauty of the wood.

thoroughly hardened, sand the area so the fill is flush with the stock. The repoured area can then be finished the same as the undamaged areas of the gunstock.

On light-colored stock woods, best results are obtained by first coloring the gouge or scratch to match the surrounding wood. Brownell also supplies water stains that produce clear, true, lightproof colors without covering the natural beauty of the wood.

Once the defective area has been stained to match the surrounding wood, use a transparent shellac stick to raise the dent or scratch to the same level as the surrounding areas. On darker wood, use the various colors of shellac sticks available.

A stock-maker's fill stick is a little easier to use than the shellac stick, although it does not give as permanent a finish. To use, merely rub it in and wipe it off. This method is especially useful for repairing finished stocks of the new synthetic-finish types that cannot be repaired by the hot shellac method previously described. Colors available include light, medium, or dark brown.

## **BLUEING SMALL GUN PARTS**

During the cleaning operation, you will probably run across screw heads and other small parts that require some light touching up. Of course, you can use any of the commercial cold bluers for the touch-up job (see chapter 12), but if you do not care to go to the trouble of setting up for this operation, blue the small parts with heat. For this method, polish the small part as you would for conventional blueing methods, then, holding it with a pair of pliers or piece of wire, heat the part in the flame of a propane torch. When the part just begins to glow slightly when in a shadow, quickly quench the part in a container of gun oil, raw linseed oil, or similar oil. The result will be a rich, deep blue that will probably match the rest of the firearm parts. If the first try does not produce a deep enough color, repeat the operation. Take care not to get the part too hot.

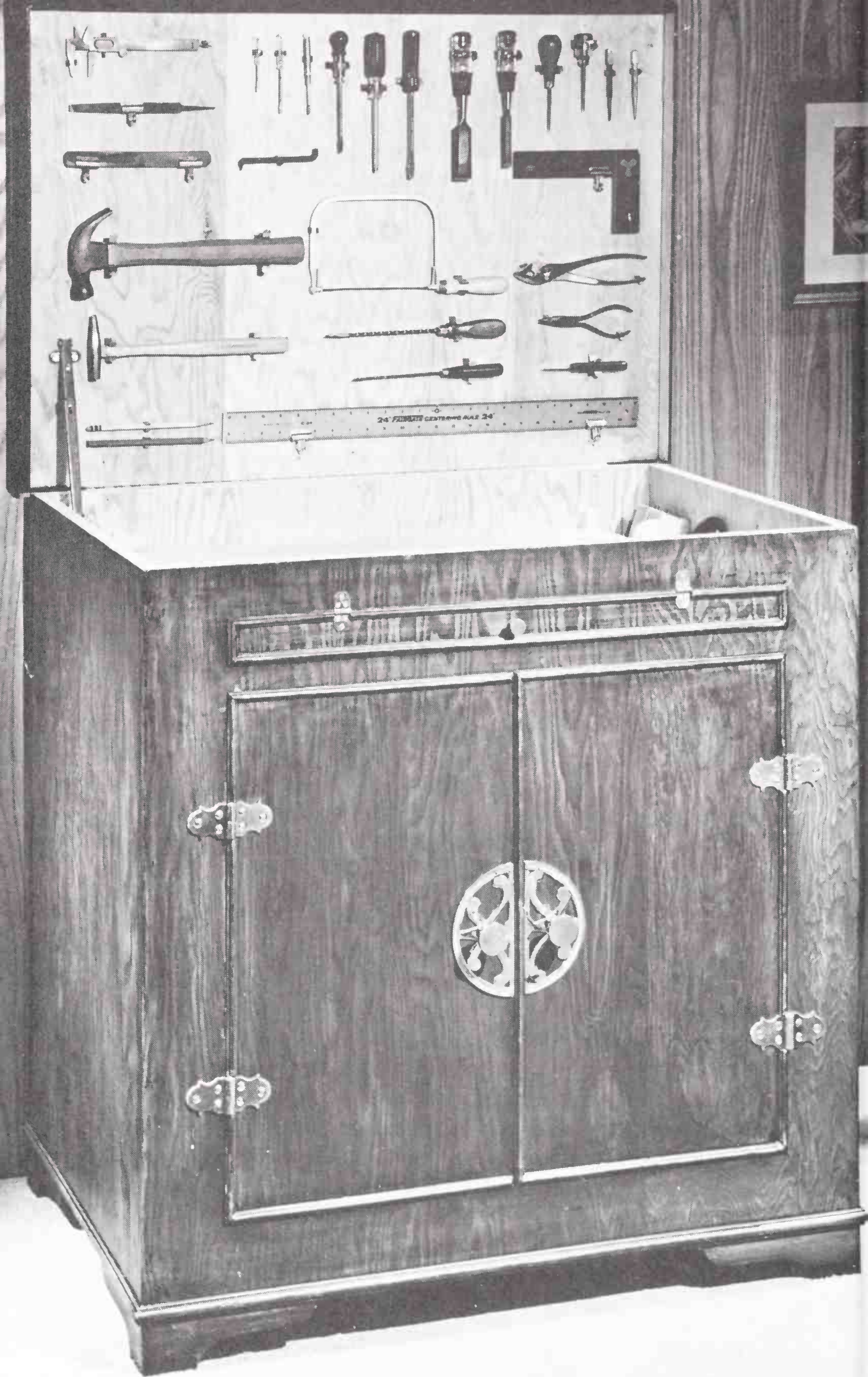


## **A Place to Work**

WHEN YOU COME right down to it, almost anyplace available can be used to work on guns. During my days in the Marine Corps, I did a considerable amount of gun work on my footlocker at the end of my bunk in a one-room barracks of thirty or forty men. I blued guns by the hot-water method in my mom's kitchen, using the kitchen range as a source of heat for the blueing tanks and the kitchen table as a work area.

Apartment dwellers probably have the most difficult time trying to find a suitable work area to tinker with their guns. Most apartment buildings have basements and utility rooms. Chances are, you could use a corner of this basement if you asked the landlord. Here you can set up a small workbench, install a bench vise, and maybe even a fluorescent lighting fixture over the bench. Since the area will probably be open to the other tenants in the building, keep your tools in a portable tool chest that can be carried back to your apartment each time you finish working.







Another possibility for the apartment dweller is renting a small, nearby garage that is not being used. You can then set up shop to suit your own taste, in a location where the noise of power tools will not disturb anyone.

A friend who lives in an apartment recently purchased a used van as a second car and set up an attractive little gunshop in the back of it. He installed a few 12-volt lights to provide illumination, attached a wooden workbench solidly to the frame and body of the van, included plenty of drawer space, and is able to spend lots of hours working on his firearms. In fact, he is able to do most of the jobs described in this book right in this van-shop.

If an out-of-the-house workshop is not possible, consider building a small workbench that can be closed up when not in use to look like a respectable piece of furniture. There are plans for these available to suit practically anyone's need. In fact, highly productive gun-tinkering shops have been hung on the back of closet door, using a workbench that folds down from a wall panel. Your work will be limited with such a setup, but with a 1/4-inch drill motor and several attachments (plus other gunsmithing tools), you'll be able to do such jobs as trigger repairs, sight installations, and touch-up blueing.

If all else fails, keep your tools in a toolbox and purchase a vacuum-type vise that can be attached to a flat surface by vacuum alone. Then you can set up shop temporarily anywhere. It is not the ideal situation, but it is a beginning.

## **BASEMENT SHOPS**

The favorite place for a home gunshop is in the basement, provided room can be found after space is allotted for the recreation room, heating plant, and utility room. Although a basement work area does have a few drawbacks, they usually can be overcome. For example, basement areas (as finished by the builder) are poorly illuminated. Improving the lighting should be one of your priorities if you plan to set up your shop in a basement. Fluorescent fixtures, depending upon the type of ceiling they will be mounted on, are the most practical.



**Fig. 4-1.** Apartment work center designed and built by John Sill of Times Mirror Magazines, Inc. The cabinet looks like a respectable piece of furniture when closed, but holds a large assortment of tools as well as a pull-out workbench.

Of course, dampness is the chief problem in most basements; some are downright wet. Dampness can cause metal objects to rust and leather slings to mildew. To overcome this problem, first see that all drains are free and working properly. Next, apply epoxy waterproofing to the basement walls from the inside and insulate the walls with foam insulating boards. A good dehumidifier, sized for your area, is added insurance for a dry basement.

Another problem, especially in older homes, is the low ceiling height in basements. This not only creates a cramped-in feeling, but also causes trouble with guns and tools accidentally hitting the ceiling as you work on them. The cost of correcting this problem is too high to make it practical, so either look for another place to work or learn to cope with the low ceiling.

When remodeling a basement for a workshop area, try to rework the heating ducts, plumbing pipes, and electrical wires so that they run between joists instead of below them. Due to their size, it may not be practical to rearrange air-conditioning ducts in this manner. An alternate possibility is to run the ducts around the perimeter of the basement and box them in to give more headroom where you will be working.

## **ATTIC SHOPS**

Only as a last resort should an attic be used as a workshop. They are often extremely hot in summer, cold in winter, and short on headroom. The first two problems can be corrected to some extent, but increasing headroom could be expensive. Add the difficulty of transporting materials to and from the attic, the matter of dirt finding its way into the living area, and the annoyance of noise and vibration from power tools and the disadvantages are quickly realized.

Good insulation, and lots of it, will do wonders in keeping the attic at a more controlled, comfortable temperature, provided adequate ventilation such as roof ventilators, either power or wind-turning, are installed. Cross ventilation can be provided by installing windows at each end of the attic. These will also provide natural light, which is usually absent from attic areas. A well-insulated attic will also keep down the noise from power tools, as will setting tools on rubber mats or other forms of isolators.

Of course, you will want to add some kind of heat for the winter

months and a window or through-wall air conditioner to keep the area comfortable in hot weather.

Although my gunshop is located in an outbuilding behind my house, I remodeled attic space for use as an office. By using good construction techniques in the renovation of the attic, I made this area the most comfortable area in the house.

To begin, I removed all the junk from the area and cleaned everything—from top to bottom. Many people eliminate this step, thinking that wall, ceiling, and floor coverings will hide and confine all the dirt and dust. Not so! Dust and dirt within the void spaces of the walls, ceilings, and floors find ways to seep through and make it extremely difficult to keep the finished area clean. So be sure to thoroughly clean before starting any remodeling job.

Electrical wiring came next. I sketched a rough floor plan of the area and laid out where furnishings would be located. Then I installed duplex receptacles, lighting, and wall switches in convenient locations. An outlet was also provided for a window air conditioner. Most localities require that all electrical work be done in accordance with the National Electrical Code and local ordinances; some require that all electrical work be done by licensed electricians. Check the requirements of your locale before doing the work. It may be necessary to have the work inspected by a building inspector before covering up the wiring. If you have any doubts about your ability in this phase of the work, let an electrical contractor do the work.

Since flooring was already installed in the attic area and the rooms below were heated, it was not necessary to insulate the floor. Insulation could have been blown into the spaces between the floor joists, but it did not seem worth the expense. However, if the area were to be a shop with power tools, I definitely would have insulated the floor. Three and one-half inches of insulation were placed in all side walls, and six inches in the ceiling. After this, I installed wood paneling on the walls and acoustical tile on the ceiling. A carpenter friend helped with the trim, and a local floor and door shop installed indoor-outdoor carpet. The area was just about ready to move into.

After calculating the heat loss of the area, I installed a 4,000-watt electric wall heater. At the time this was the least expensive heating system available. However, aware of the spiraling fuel costs, I also made provisions for a wood-burning stove, using the existing chimney and flue that ran through one corner of the attic. A cut was

made in this chimney, a thimble installed, and a wood-burning stove connected. When no dry firewood is available, or building a fire is too much trouble, the electric heater provides all the heat needed.

## **GARAGE**

A garage is one of the best places to locate a shop, especially if it is seldom used to store the family car. Although often drafty and hard to heat in winter, a shop located in the garage has many advantages over one located elsewhere in the home. First of all, a garage shop allows you to work at odd hours of the day and night without disturbing anyone. Furthermore, you do not have to worry about odor from bore cleaner, blueing, and other chemicals polluting your home. And no one will ever see your messes because the garage is a place not normally seen by visitors.

If your car is kept in the garage, you have to make some adjustments. If the garage is large enough, put a bench along the back or side wall, and store power tools along the walls until you are ready to use them; then to use them move them out, once you have moved the car to make room. When space does not permit a regular bench, consider one that swings down from the wall. The bench is hinged on its back side and swings either up or down when not in use.

The ideal setup is to use half of a two-car garage as a shop and the other half for parking a car. Build a carport if you need shelter for a second car—it is much cheaper than building an enclosed shop.

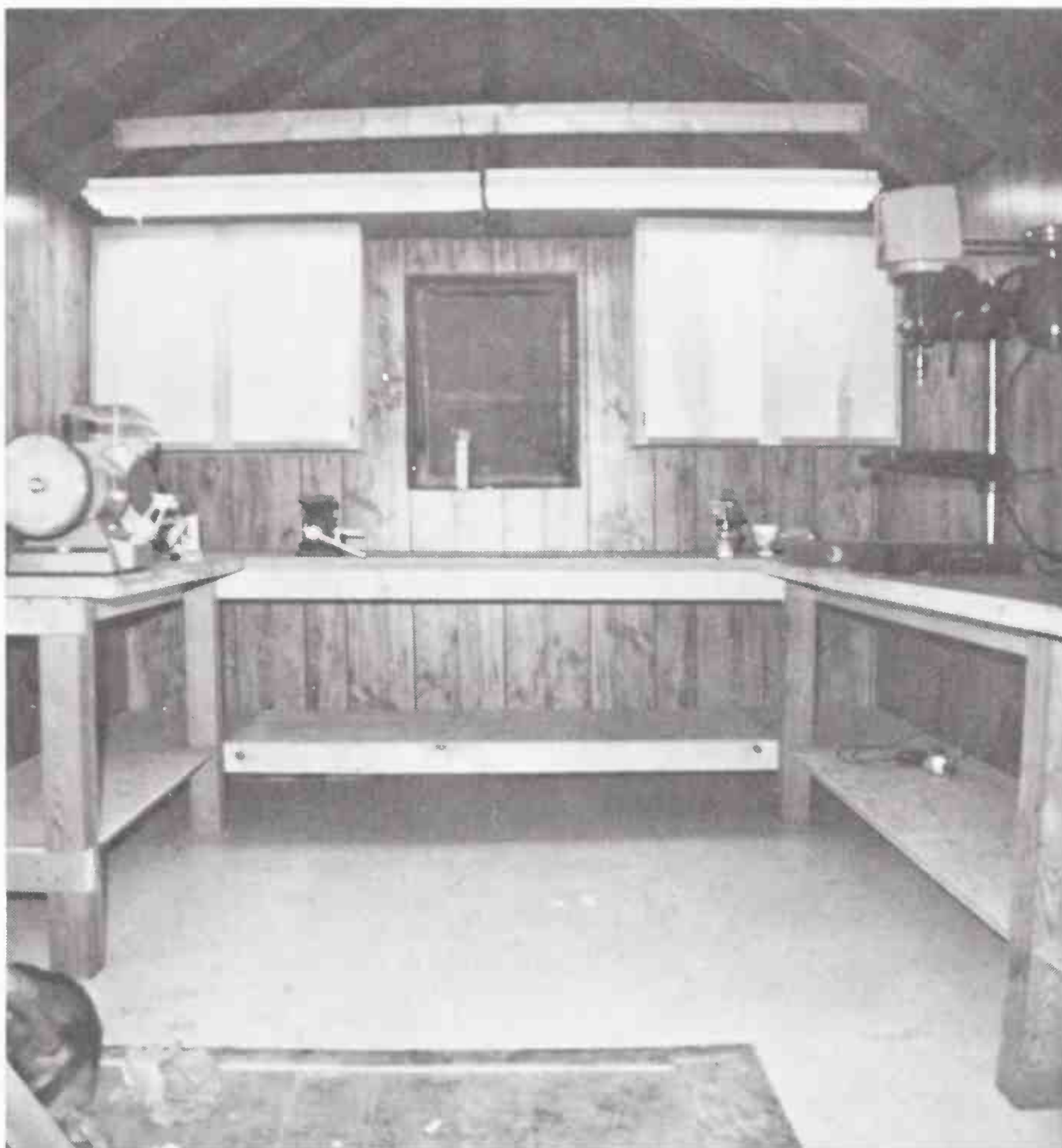
## **OUTBUILDINGS**

My own shop is located in an outbuilding that previously had been used as a smokehouse. After the old building was reinforced, the foundation leveled, wiring installed (including fluorescent lighting), insulation and wall paneling put in place, floor tile laid, and a U-shaped workbench built, the building was ready to move into.

The interior is only 9 feet by 13 feet and it did not take long for the area to fill up with tools. But even with a drill press, metal-turning lathe, bench grinder, and hand-loading equipment, there is plenty of bench area.

However, since I needed another shop, I constructed a 25-by-35 foot, two-story building behind my house. The upper area is used to





**Fig. 4-2.** Author's U-shaped workbench built in an outbuilding in back of his home.

store gun parts and other items, while the lower level houses the general shop, with a separate blueing room, rest room, and a small retail-receptionist area.

## **PORCHES AND CARPORTS**

In mild climates, a porch or carport may be all that is needed to perform gun work. A carport, for example, with a large floor-to-ceiling storage area in one end can be used to store tools out of the weather when not in use. Then when the storage area is opened, it could reveal a workbench and power tools. While the workbench is



**Fig. 4-3.** A flat surface, a bench vise, and Brownell's Assembly/Disassembly Tool Kit will enable one to perform a lot of gun work from cleaning to troubleshooting and repairing malfunctions.

stationary, put power tools on rollers so they can be rolled out for use.

Such an area has several disadvantages, but if no other place is available, it is one possibility. Heavy, blowing rains and cold temperatures prevent use of the shop, and you have to wait for fair weather to work on guns. To overcome these inconveniences, you can enclose a carport with comparatively little expense.



Since the walls that are added to enclose a carport will be exposed to the weather, be sure to insulate well. Use conventional wall framing to enclose the open wall of the carport, or perhaps use jalousie windows. A jalousie window consists of a series of movable, overlapping glass louvers, which pivot in unison—usually by a crank-and-gear system. Such windows are best used in southern climates, where maximum ventilation and flush exterior and interior appearance is desired. These windows can be arranged so that an entire wall, from about eighteen inches above the floor to a foot or so below the ceiling, is constructed of windows.

When used in southern climates, the enclosure will act like a greenhouse and provide heat through the glass from the sun's rays on chilly days. If it gets too hot, open the windows for ventilation.





## **Tools that Work**

NOTHING IS MORE frustrating than to begin an interesting project only to find halfway through that you lack the proper tools or materials to complete it—or the knowledge to make the most of the tools you do have. In cases like this, the gun usually ends up in a professional's hands, and the beginner is so discouraged that a long time passes before another attempt is made, if ever! You can avoid these frustrations (or at least cut them to a minimum) by thoroughly planning your projects before beginning and making certain that all the necessary tools and materials are at hand. By doing so, you'll not only finish the project, but you'll derive more enjoyment and gain enough self-confidence to encourage you to attempt more advanced projects sooner.

### **BASIC GUNSMITHING TOOLS**

The selection of gunsmithing tools should not be made lightly. Because of the critical nature of gun repair and the value of the



be performed without removing tight-fitting screws from the firearm. Therefore, the selection of a proper set of gunsmithing screwdrivers should be a primary consideration.

Most of the screwdrivers that are available at hardware stores are the double-wedge type—the type swaged on a punch press. When such a screwdriver is used in a deep screw slot, such as the ones most often found on firearms, the blade transmits its torque to the top of the screw slot. Since there is only a small area of contact between the blade and the screw slot, the screw will be scored if very much pressure is applied; or perhaps one section of the screw head will break off. This wedge shape also tends to back the driver out of the screw slot (fig. 5-2).

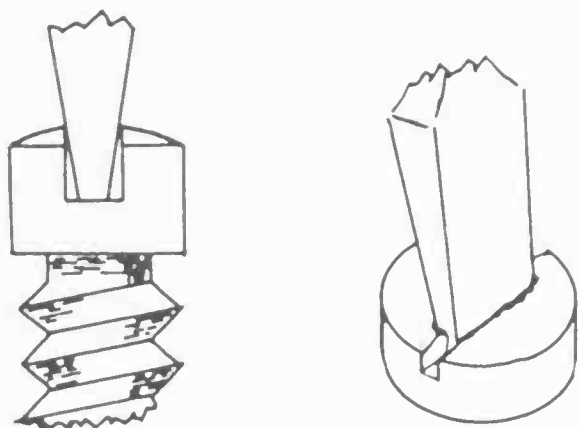


Fig. 5-2. The double-wedge-type screwdriver is not suited for gun repair work, since the blade will transmit its torque only to the top of the screw slot.

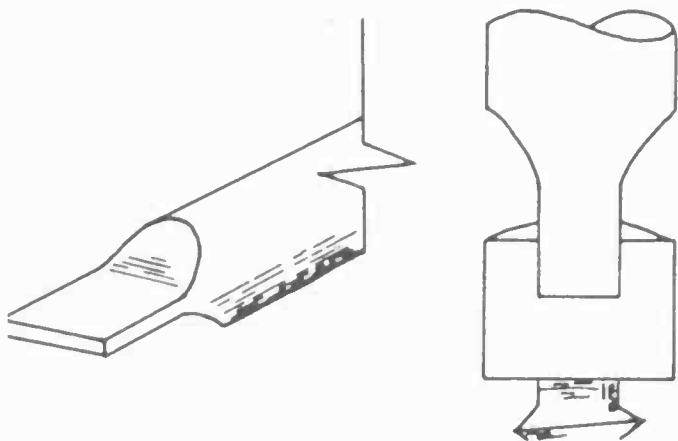


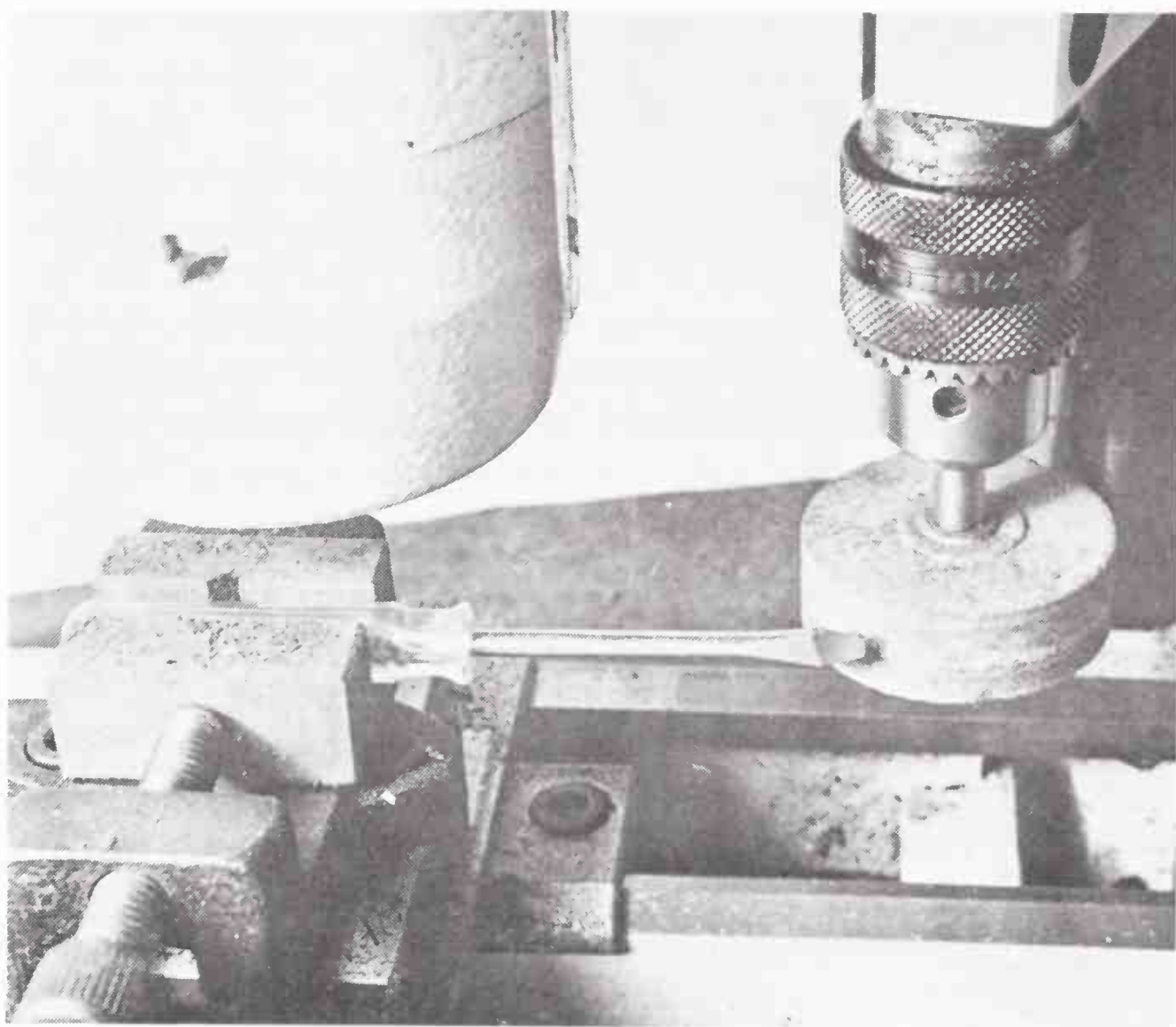
Fig. 5-3. Screwdriver blades for gun work should be ground as shown here.

Screwdrivers used for gun work should be ground as shown in figure 5-3 and fit the screw slot exactly. This way the torque is applied at the bottom of the slot where the screw is the strongest.

The gunsmithing screwdrivers supplied by Brownell's, Chapman Manufacturing Co., and Bonanza Sports are the most popular with professional gunsmiths.

Even though gunsmithing screwdriver sets come with many different sizes of bits, you might still have to grind a screwdriver tip to fit a particular screw slot. In fact, many hobbyists and most professionals make their own screwdrivers out of drill rods and then





**Fig. 5-4.** A circular grinding stone is often used to grind screwdriver blades for gun work.

install either a wooden or plastic handle on them for gripping. A circular grinding stone attached to a drill motor will do the trick, but you will have to eyeball the radius and width of the bit. It is easier to purchase a B-Square Blade Makers which will enable you to accurately grind screwdriver blades or make your own. This device can be clamped to any bench grinder or drill press to hold screwdriver blades, and the design assures parallel blade faces and blade tips.

To grind screwdriver tips from tool steel drill rod (fig. 5-6), use a steel consisting of 50 percent carbon, 40 percent manganese, 1 percent silicon, and 0.5 percent molybdenum, the finest steel available for screwdriver blades. Once the tips have been ground to size, wrap them in stainless steel foil to prevent scale from forming during the hardening. Using a propane torch, heat the rod to bright cherry, and just before it changes to red-yellow, quench the part in oil. To draw, preheat the kitchen oven to 300 degrees Fahrenheit, put the

Table 1  
GUN SCREW DIMENSIONS

Firearm	Blade Width (inches)	Shank Length (inches)	Blade Thickness (inches)	Blade Length (inches)	Curve Radius* (inches)
Remington and Winchester, plug screws	1/8	4 1/4	.023	.048	1/4
Lyman, Leupold, Redfield scope screws	3/16	4 1/4	.032	.046	1/4
B & L, Weaver, Buehler scope screws	3/16	4 1/4	.037	.046	1/4
Williams 10-32 screws	1/4	4 1/4	.041	.0625	1/4
Most Guard Screws	5/16	4 1/4	.040	.0625	1/4
Shotgun Guard Screws	1/4	4 1/4	.020	.050	1/4
Winchester, Browning **O/U Ejector	3/16	4 1/4	.020	.046	1/4
Browning O/U trigger guard	3/8	4 1/4	.021	.062	1/4
Browning Auto Receiver Screws	1/4	4 1/4	.024	.062	1/4
Guard Screws and General Purpose	5/16	4 1/4	.034	.062	1/4
Redfield Stream Lined Scope Mount Rings	11/64	4 1/4	.031	.046	1/4

\*From the flat portion of the blade to the outside of the shank.  
\*\*Over/Under.

part in the oven for an hour, and then allow it to air cool. This will make one of the toughest screwdriver blades available. Just be careful with the torch while heating the parts. Do not burn yourself or use an open flame around any combustibles.

Instrument Screwdriver

There will be certain screws (mostly on gun sights) that will require the use of a jeweler's, or instrument, screwdriver. One or

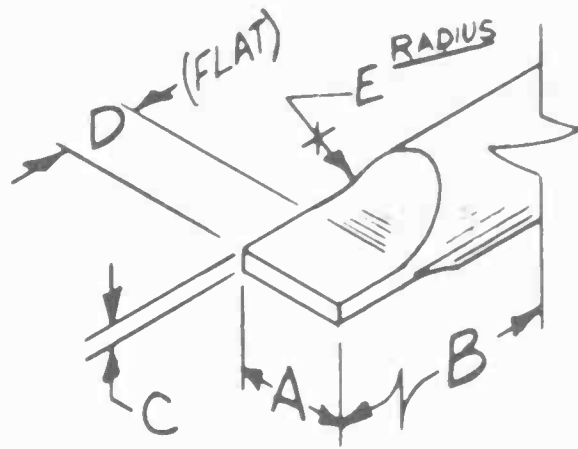


Fig. 5-5. How gunsmithing screwdrivers are measured: A, blade width; B, shank length; C, blade thickness; D, blade length; E, radius of the curve from the flat portion of the blade to the outside of the shank.

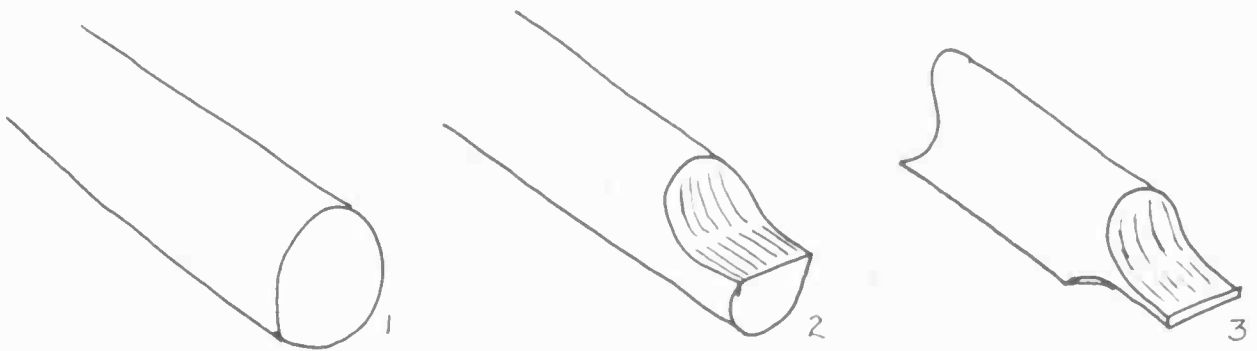


Fig. 5-6. To grind screwdriver tips from tool steel drill rods: 1 Drill rod used as blank for gunsmith screwdrivers; 2 Use circular grinding wheel to grind one side drill rod; 3 Reverse rod, grind the other side.

two different sizes will do at first, but eventually it may be necessary to obtain a set of about five different blade sizes.

### ***Pin Punches***

Most firearms contain drift pins that require different size punches to remove. Consequently, you will need a complete set of drift punches, along with a starter punch or two. It is very important to use a starter punch rather than to try to break loose a stuck pin with a long drift punch or pin punch, which usually ends up with the punch getting bent or broken. Avoid this by getting the pin started with a starter punch and then "drifting" it out with a pin or drift punch. Sure, punches will still get bent and broken from time to time, and have to be replaced, but such breakage will occur less frequently if a starter punch is used first. Several sizes are available.





Fig. 5-7. Two sizes of instrument screwdrivers suitable for use on gun-sight screws.



Fig. 5-8. Several sizes of pin punches that will handle the majority of firearm disassembly operations.

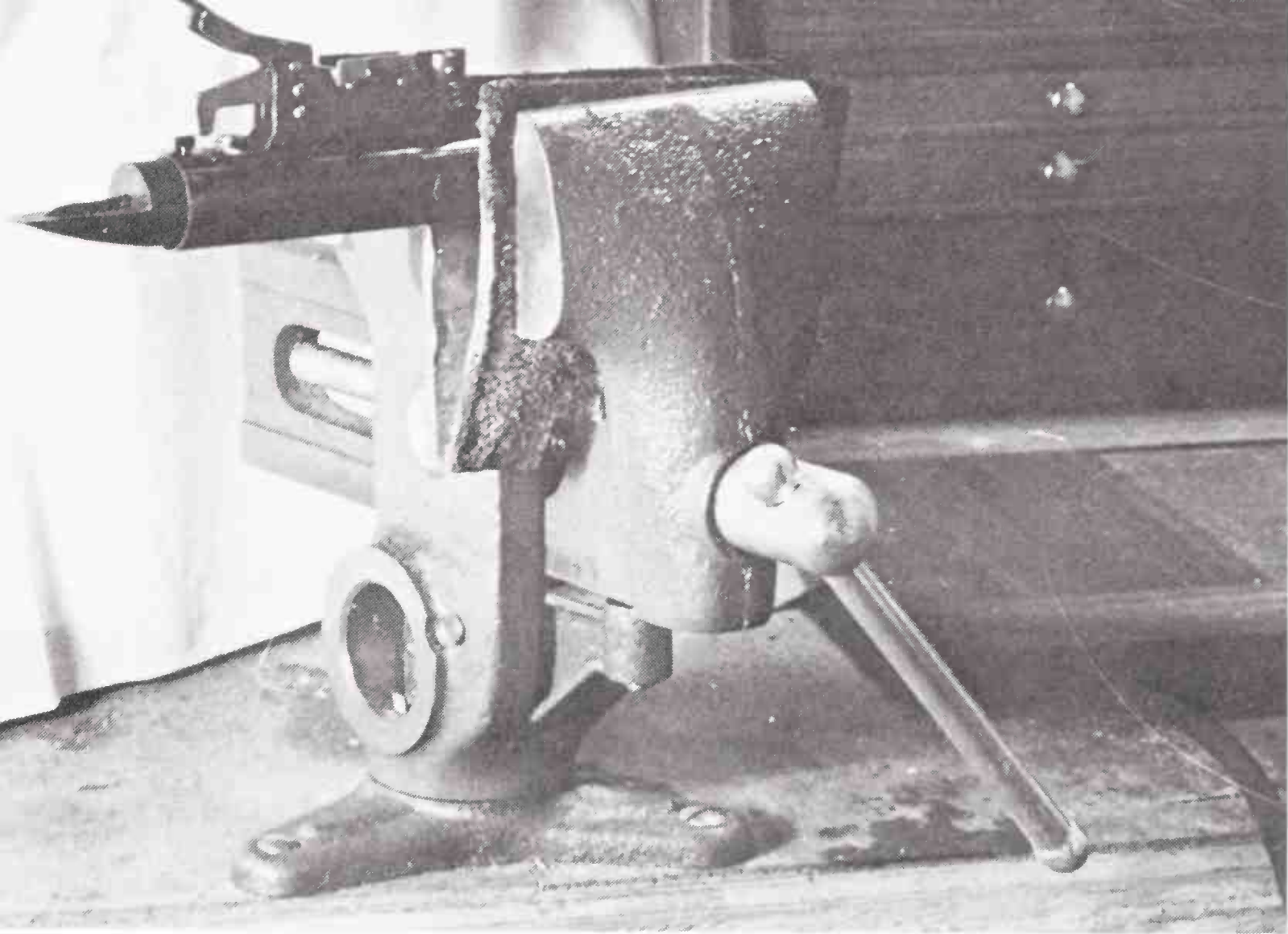


Fig. 5-9. The Versa-Vise is an excellent choice for the home gunsmith.

### **Vise**

A bench vise is almost indispensable as an aid while working on firearms. If you have a workbench where the vise can be mounted permanently, then by all means buy a heavy-duty, swivel-base machinist's vise that can be used for holding guns and checkering cradles. The Versa-Vise (fig. 5-9) is an excellent choice for the home gunsmith as it gives both vertical and horizontal holding positions; rotates a full circle in either position; and has a built-in anvil and removable, serrated pipe jaws for round objects up to 1½ inches in diameter. The vise automatically locks in the desired position when the jaws are clamped tight.

To prevent marring of blued metal surfaces and wood finishes, equip the bench vise with protective jaws. Brass and lead jaws are available from Brownell's and Frank Mittermeier, Inc., or make a set of removable jaws out of leather and wood. While making these, make a set of felted wood jaws to hold stocks and other finished wooden parts.

One of the most difficult gun parts to control without it breaking or slipping out of your holding device is the mainspring for side-plate shotguns or muzzle-loaders. The little mainspring vise shown



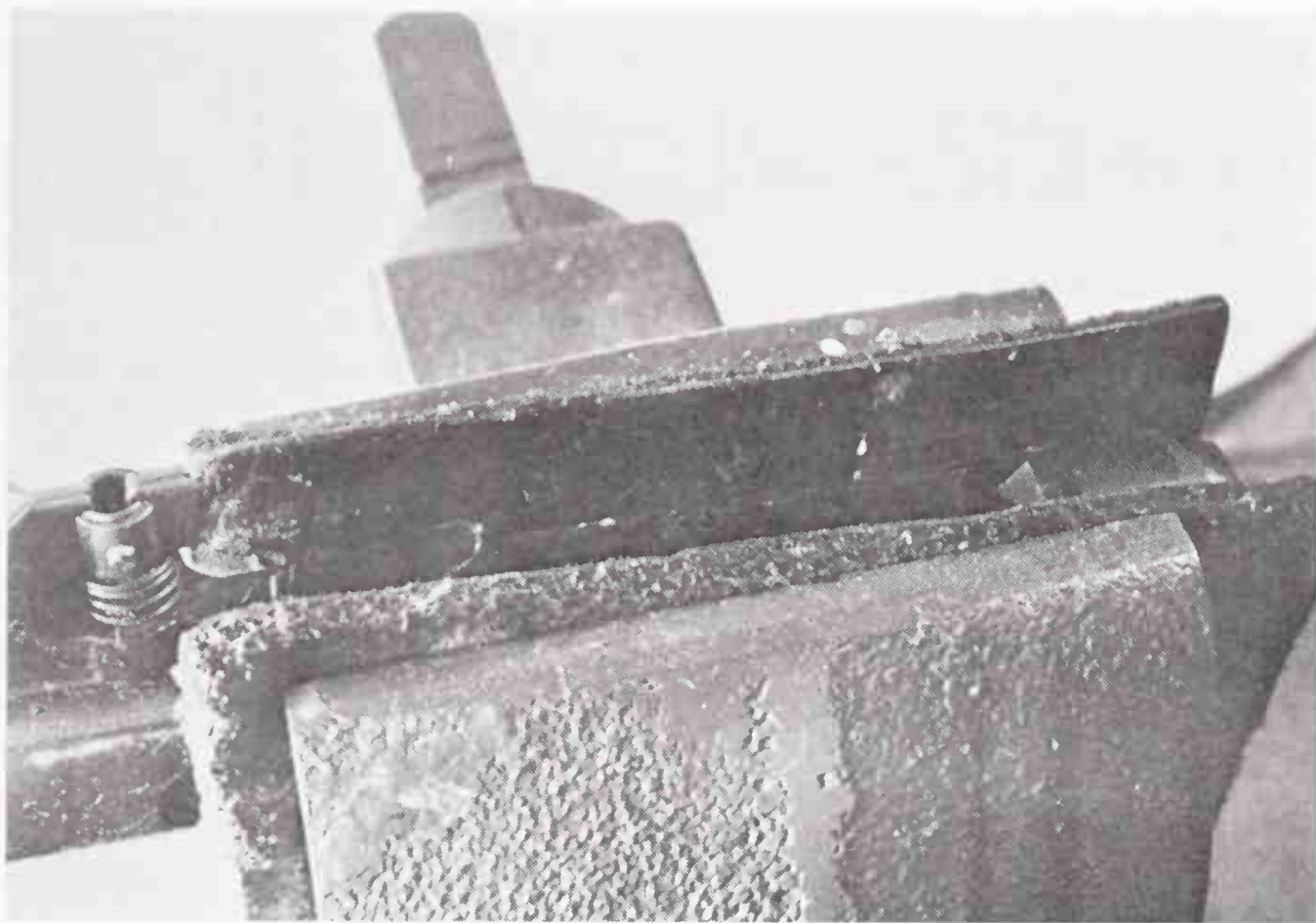
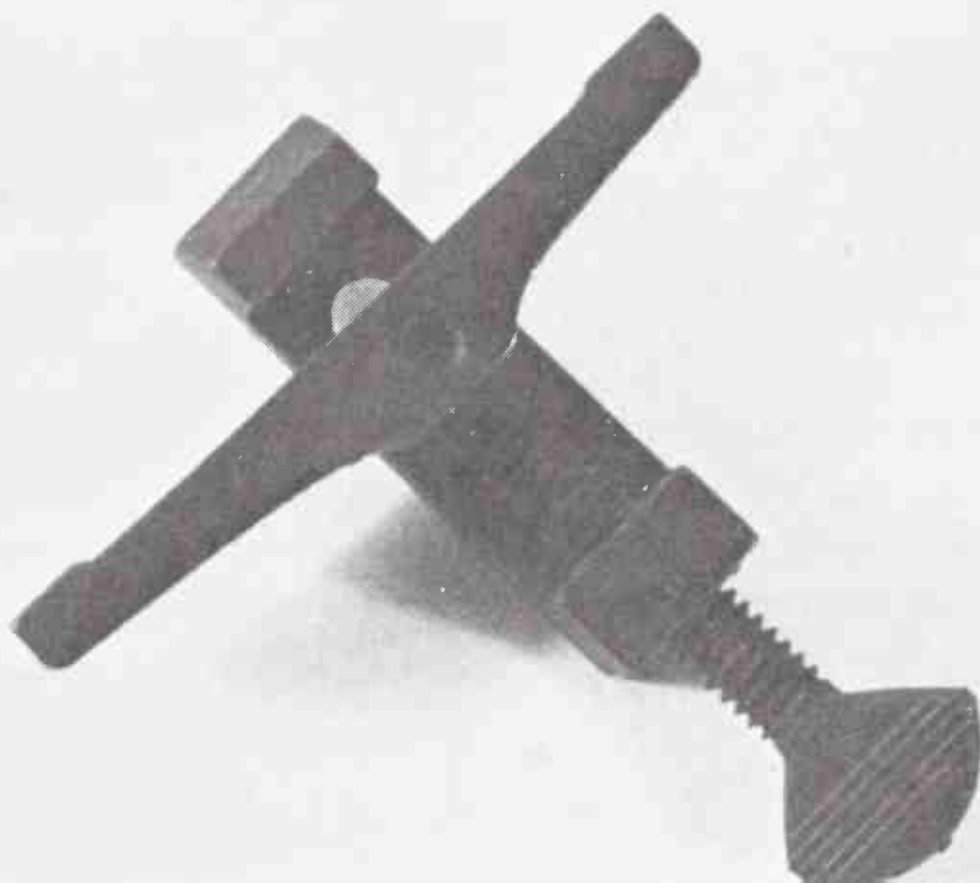


Fig. 5-10. A set of removable vise jaws made from leather and wood will serve most of your needs.

in figure 5-11 saves a lot of problems. Merely loosen the screw, insert the vise onto the mainspring, and tighten. As pressure is applied by the screw, the spring will depress and can be easily slipped out of the lock.

Fig. 5-11. This mainspring vise will save a lot of headaches when removing or installing mainsprings in side-lock shotguns or muzzle-loaders.





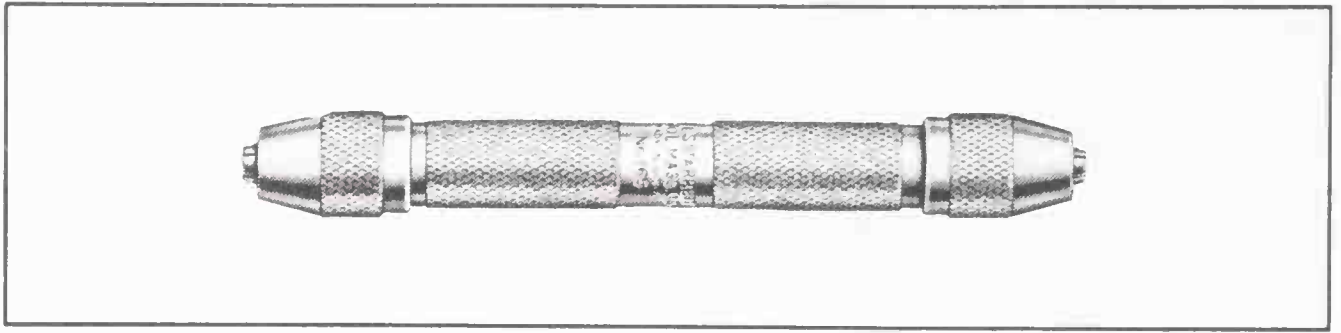


Fig. 5-12. A pin vise is ideal for holding small rods and pin stock for filing, grinding, or polishing.

A pin vise can also be a handy tool. It has a small, close-fitting chuck that is held in the hand while in use. It takes any size rod from around .030 to .062 and is ideal for holding small rods and pin stock for filing, grinding, and polishing.

### ***Brass-Nylon Hammer***

A brass hammer is standard equipment on all gunsmithing benches. Because of the soft nature of the metal (as compared to steel), it is ideal for driving or tapping parts where marring or nicking must be avoided. A nylon surface on the opposite face makes the hammer more versatile, offering the user a second choice in cases where even more care must be taken.

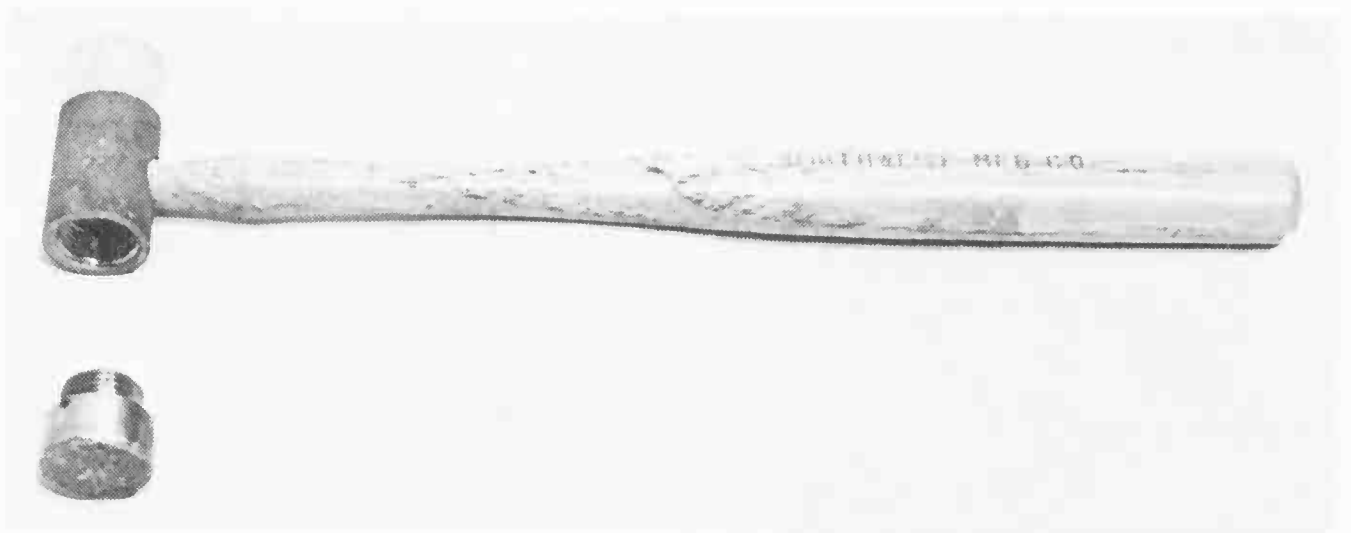


Fig. 5-13. Brass-nylon hammer should be standard equipment on every gunsmith's bench.

### ***Nylon-Brass Drift Punch Set***

The dual tips of the punch set in figure 5-14 provide for a variety of jobs. The brass tip, for instance, is excellent for driving out dovetail sights, but should not be used on blued surfaces since it may leave

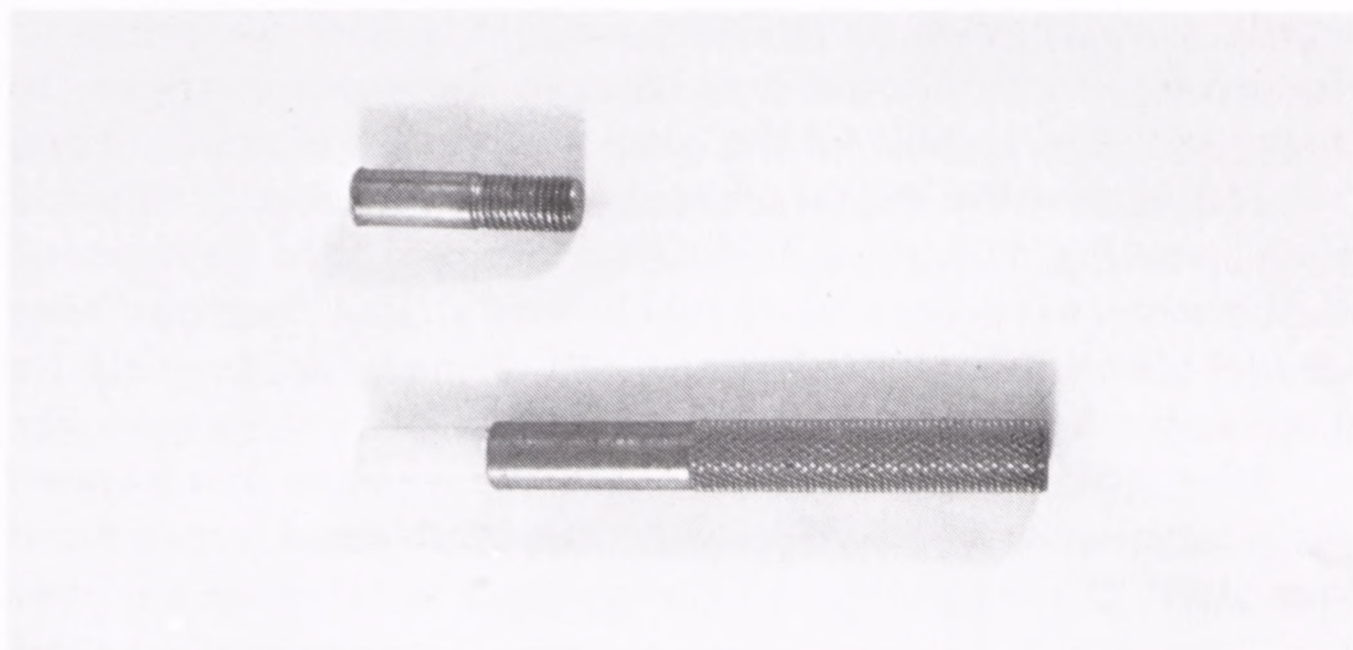


Fig. 5-14. The dual tips of this punch set are excellent for driving out dovetail sights and a host of other jobs.

brass marks on the metal. With the nylon tip though, a sight or a pin can be driven out without marring or transferring brass coloration to the finish.

### *Parallel Pliers*

The pliers shown in figure 5-15 are not intended for twisting-turning jobs, but for precision holding of gun parts. Because of the

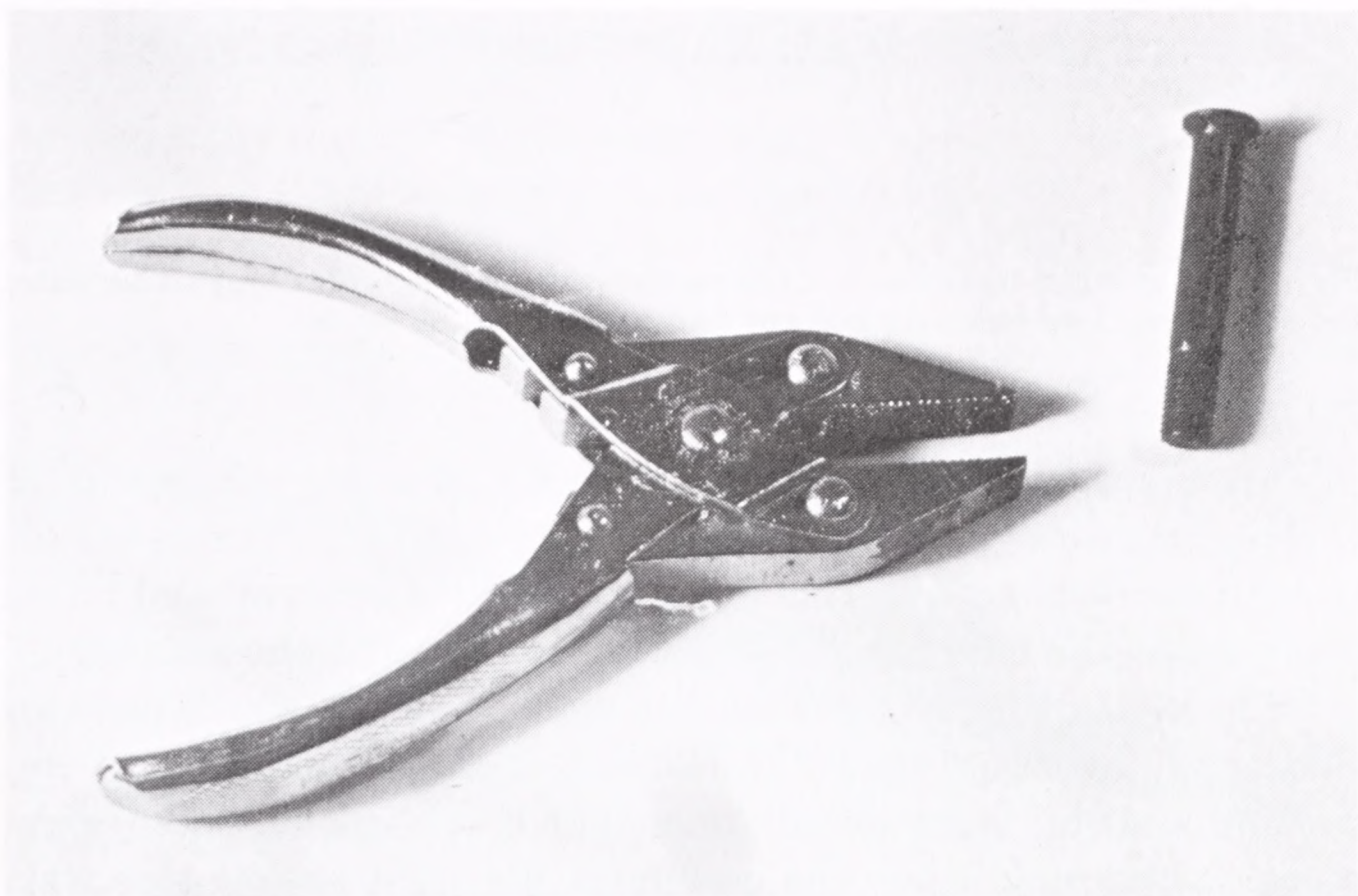


Fig. 5-15. Parallel pliers are intended for precision holding of gun parts.

parallel jaws, there is no tendency for objects, such as springs or rounded objects, to slip out from between the jaws when pressure is applied. Also, because of the compound nature of the leverage, tremendous pressure can be exerted. This is particularly valuable when inserting drift pins, holding springs, or other small parts. Furthermore, wrapping a heavy rubber band around the grips makes parallel pliers a very practical and useful small vise, not only for shop use but for emergency use in the field.

After a time you may find a need for other pliers—needle nose, combination, pump, vise-grip—which can be obtained from a hardware store.



Fig. 5-16. Eight-inch, narrow hand file is included in the Brownell Kit.



Fig. 5-17. A sight-base file is a triangular-shaped file with one cutting side; the remaining two sides do not cut and are known as "safe."

## ***Files***

Files are available in many shapes and sizes, with teeth of varying coarseness. Probably the handiest size for beginners is an 8-inch narrow hand file. This file is similar to a conventional pillar file, but has the advantage of one cutting edge and one safe edge.

The next file you may need is a sight base file, which has two sides that do not cut (fig. 5-17). Not only is this file ideal for cutting dovetail slots for sight installations, but it serves many other purposes, for example when the user must file right up to a side wall or slightly undercut without damaging the sides of the cut.



After purchasing these two files, you may want to start adding others to your inventory of tools. An 8-inch mill file and a 10-inch mill file (both in fine cut) will see plenty of work around a gun shop, and a 12-inch flat bastard cut can take off a lot of metal in a hurry. Next in line will be a set of gunsmith needle files in both medium and fine cuts.

Eventually, you will also want several 6-inch round files for adjusting screw and pin holes, scope mount holes, fine cuts on tightly curved parts, and all types of parallel round cuts. Four diameters— $\frac{3}{32}$  inch,  $\frac{1}{8}$  inch,  $\frac{5}{32}$  inch,  $\frac{3}{16}$  inch—will handle most gunsmithing needs. Cuts are normally 00 (very coarse), 0, No. 2, and No. 4 (very fine).

If you do much gunsmithing work, you will frequently have to deepen old screw slots, make slots in new screws, and touch up botched screw slots. Screw head files are just the thing for these jobs. Such files cut only on the edge; the wide flat sides are smooth and will not damage the screw head while filing.

Files are very simple tools, yet a person who knows how to use them can do remarkable things with them. For example, gunsmiths in Afghanistan frequently make their own gun parts using only files. Sure, hand filing is slower and more difficult than machine filing, but with patience, quite a lot can be accomplished.

Files are meant to cut in one direction only. And unless the right amount of pressure is applied, the piece will be damaged. In addition, the teeth of the file get clogged up with metal filings. If this condition is allowed to go unchecked, the file will no longer cut effectively and will also score the work. So when buying your first

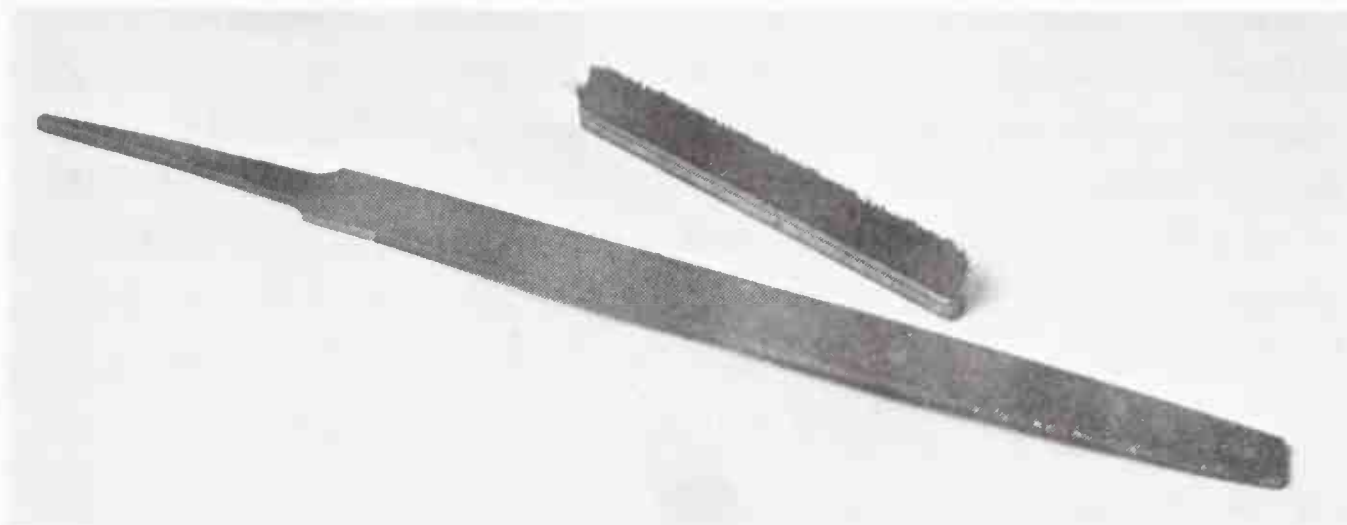


Fig. 5-18. A file card or wire brush is essential for cleaning file teeth to ensure proper cutting.

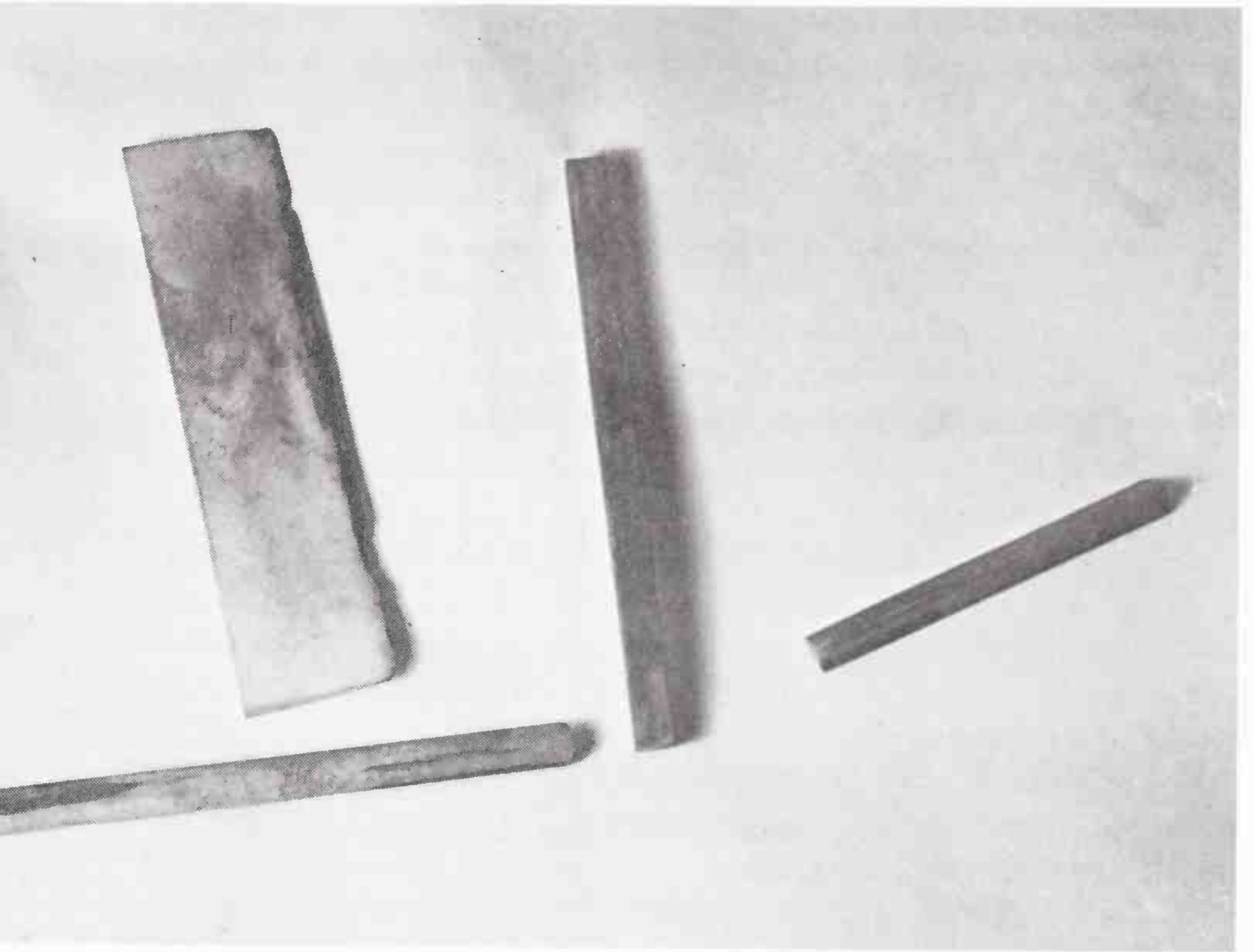


Fig. 5-19. An assortment of gunsmith's honing stones is essential for smoothing many metal-to-metal contacts.

file, buy a file card—a wire brush made especially for cleaning the teeth of files. Common chalk rubbed across the teeth will minimize clogging (often called *pinning*), but still use the file card to ensure proper cutting.

Each file should be provided with either a plastic or wooden handle to protect the user's hands. It will give you a firmer grip on the file tang, but even more important, if the file binds or catches on the work, the sharp tang will not cut a hand or wrist.

### ***Honing Stones***

An assortment of gunsmith's honing stones (India and Arkansas) is almost indispensable for gun work. Sharpening trigger sears

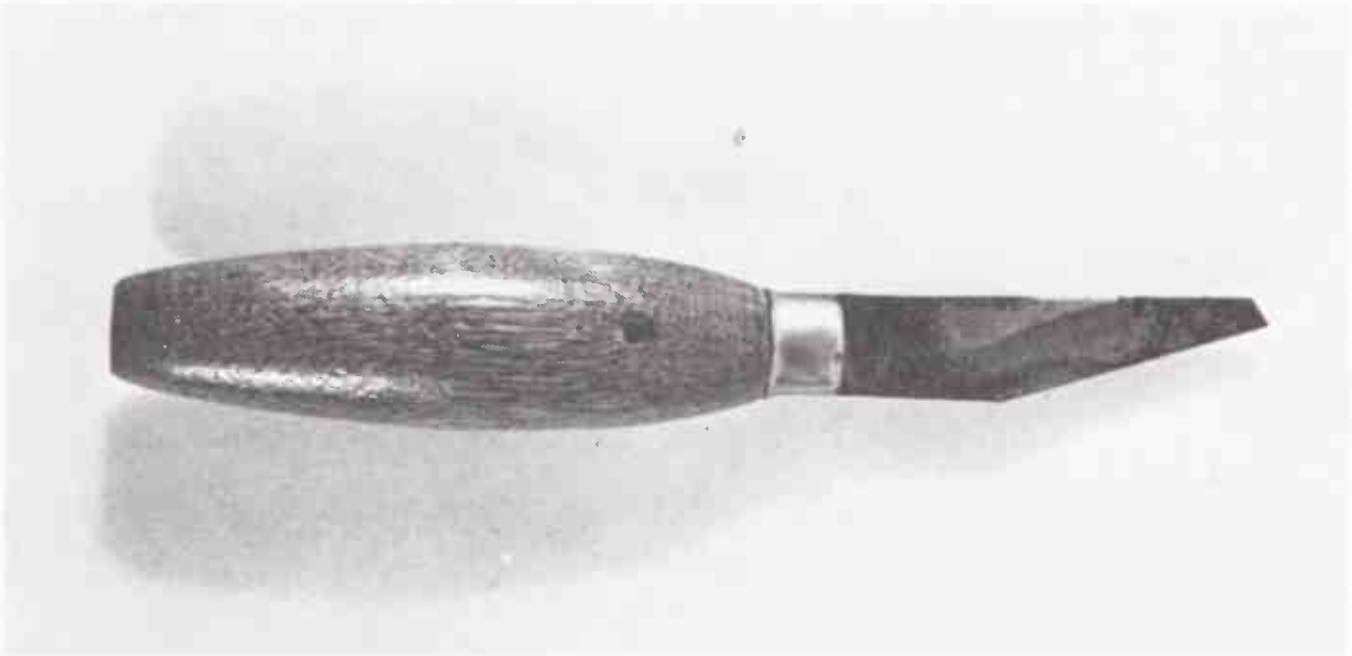


Fig. 5-20. A sharp bench knife will come in handy.

for smoother trigger operation, and smoothing the metal-to-metal contact of all movable action parts are just a few of the many uses for honing stones.

### **Hacksaw**

The hacksaw is a metal cutting tool that, like a file, cuts in one direction only. When using it, do not let the teeth drag over the cut on the backward movement. Rather, raise the saw blade slightly on the rearward movement, applying pressure only on the forward stroke. This way, you will cut faster and smoother, and the blades will last much longer.

Hacksaws are relatively inexpensive so purchase the best one you can find. Look for a sturdy frame, and leave the dime-store varieties alone. The same is true for hacksaw blades. Buy the best high-speed blades you can find in the following teeth spacings: eighteen teeth to the inch for roughing cuts and for use on heavy stock; twenty-four teeth to the inch for smoother, more accurate cuts; and thirty-two teeth to the inch for cutting thin tubing.

### **Bench Knife**

A strong, sharp blade on your bench knife will come in handy for gun inletting, cutting leather slings to size, incising, and relieving. The knife shown in figure 5-20 comes in the Brownell tool kits. Besides this one, use a set of X-acto knives, keep one razor sharp and the others dull for rougher work.



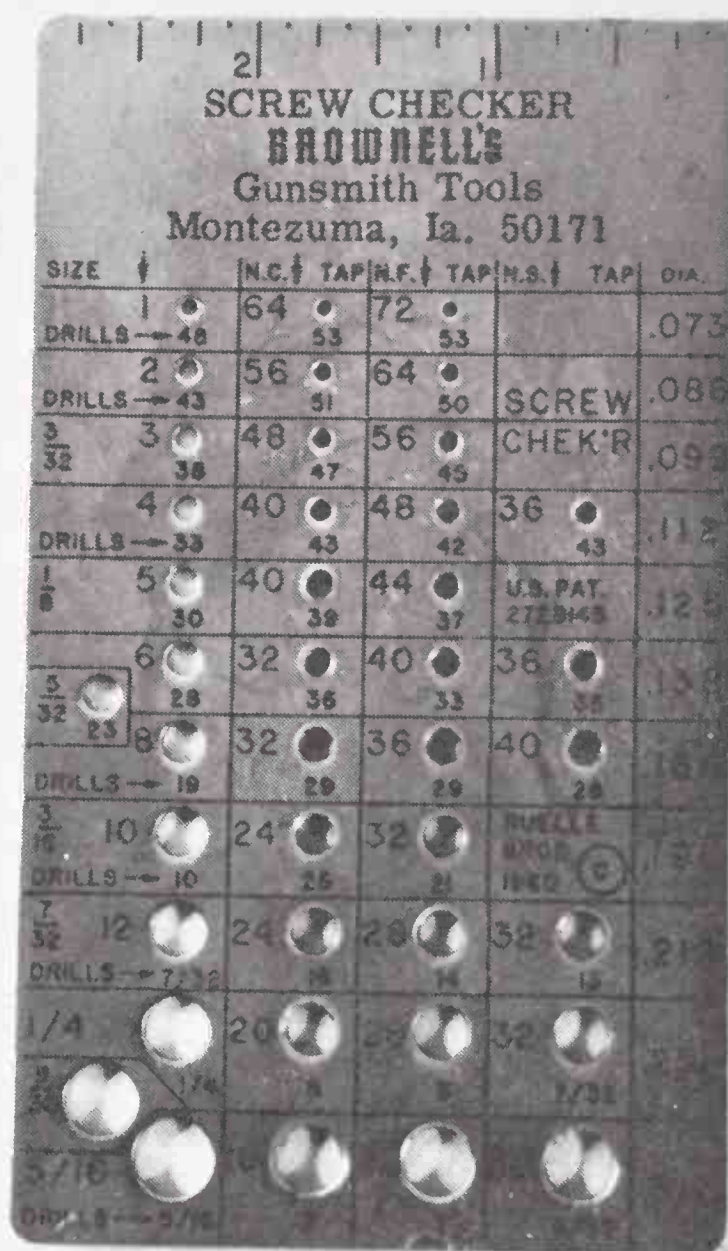


Fig. 5-21. Screw Check'R is a gauge used to indicate screw and drill sizes.

### ***Screw Check'R***

Since few beginners have a screw gauge and a micrometer, this simple tool is included in the Brownell kits. This gauge will also give drill sizes.

### ***Drills***

A hand drill is relatively inexpensive and can suffice for most of the hobbyist's drilling. However, you will eventually need a drill press. With this, you can drill holes for mounting telescopic sights, drum-sand irregular wood shapes, grind screwdriver tips, and polish

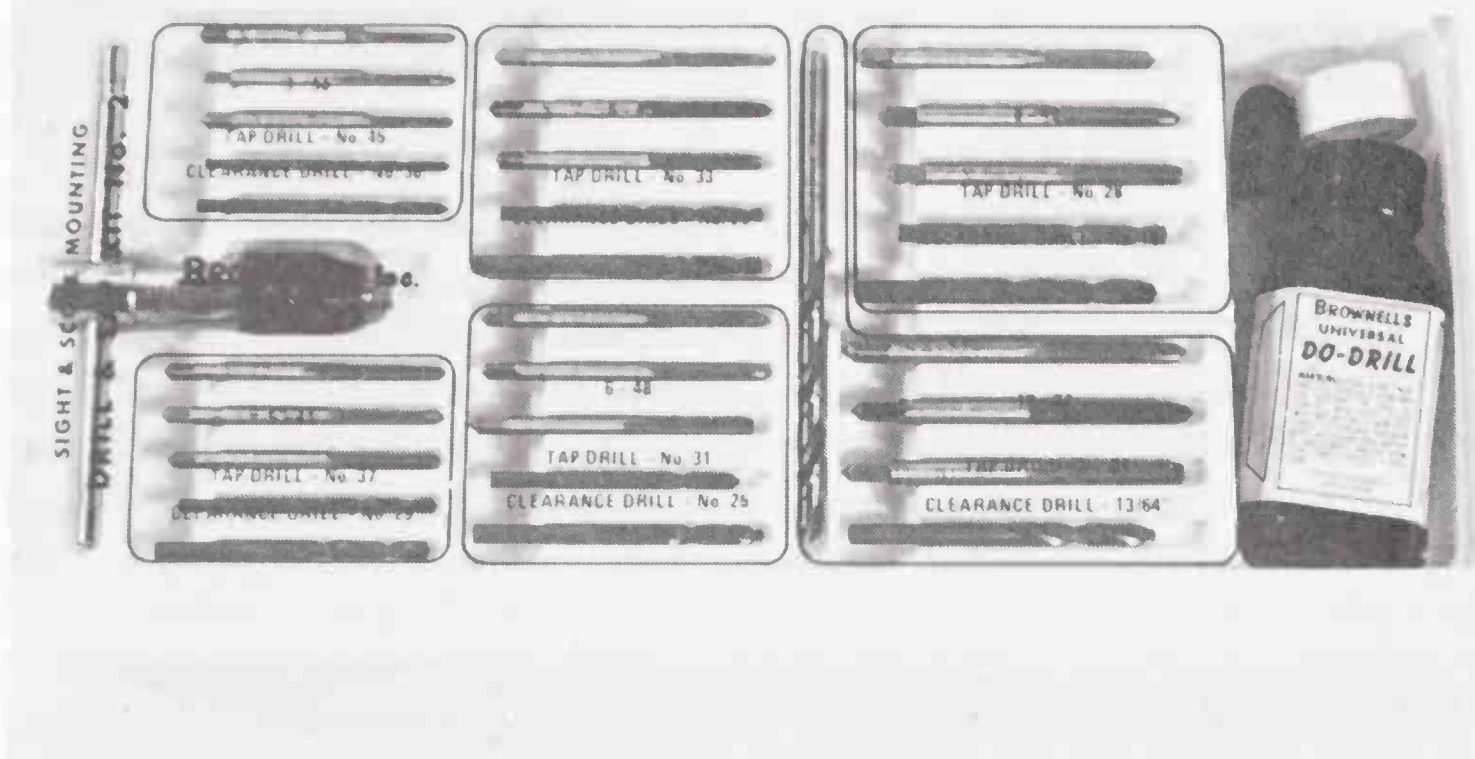


Fig. 5-22. Brownell's Sight and Scope Mounting Drill and Tap Kit No. 2 will handle the majority of sight-mounting needs.

trigger guards and other small parts when a polishing bob is chucked into the drill.

Drill bits are another consideration, along with taps to thread screw holes. These can be purchased as needed, but it might be better if you buy one of Brownell's Sight and Scope Mounting Drill and Tap Kits No. 2. If you anticipate doing much scope mounting on rifles that have not been predrilled at the factory, this kit will pay for itself many times over.

### *Disassembly Tools*

The Brownell Assembly/Disassembly Tool Kit contains three specialty tools for disassembling certain guns: Colt Pistol Wrench, Winchester Model 12/Ithaca 37 Wrench, and Extractor Spring Pliers.

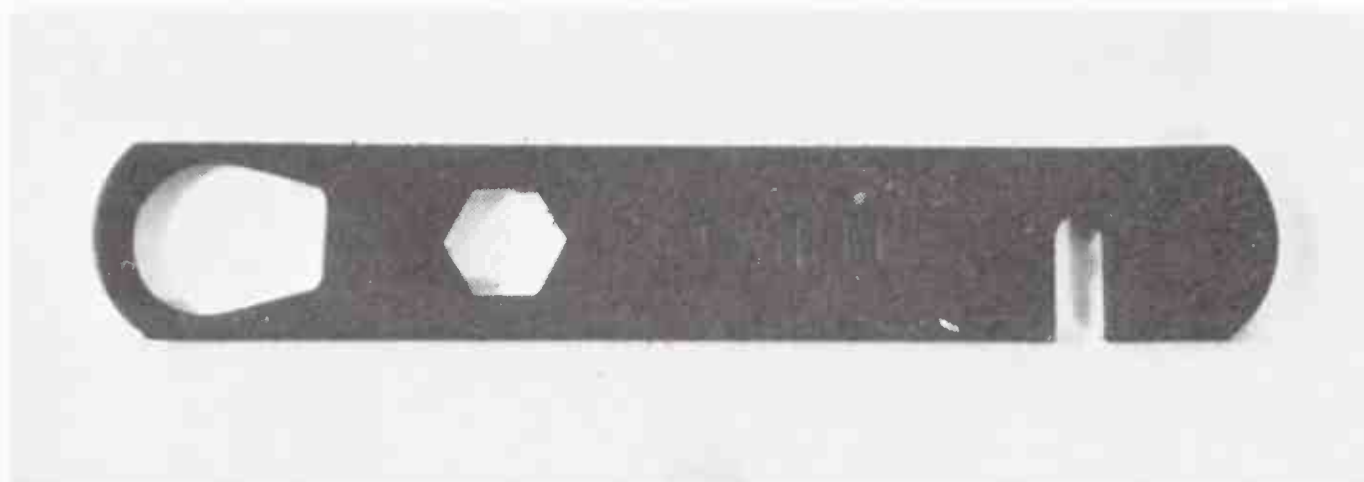


Fig. 5-23. Disassembly tools will prove invaluable for disassembling firearms.

## POWER TOOLS

Buying power tools can quickly get expensive, but to save time and elbow grease, it is advisable to purchase a few. Make your first power tool a  $\frac{1}{4}$ -inch or  $\frac{3}{8}$ -inch portable, electric drill. You will be able to use it and its many accessories as a drill press; as a disc sander for shaping stocks and recoil pads; as a buffer for polishing gun metal prior to blueing; as a carding wheel to remove rust during the hot water method of gun blueing; and as a bench grinder.

## SPECIALTY TOOLS

About the time you think that you are equipped to tackle any project, you will have a gun that requires additional tools either to disassemble it or repair it. Do not let this bother you. More than likely, an additional tool can be purchased locally, and you will have it when the situation arises again. One of the exceptions is the purchase of a tool to remove the stock bolt from some two-piece stocks. In most cases, a standard screwdriver with a half-inch blade and fifteen-inch shank will work. Recently, however, manufacturers have strayed from the conventional screw-slot bolt. Some have hex-head bolts, some screw slot, and others are a combination of both. All are difficult to remove and often require special tool setups to handle the force required to remove them correctly and to retighten solidly. Also, many stock bolt holes are only slightly oversized, requiring special thin-walled sockets.

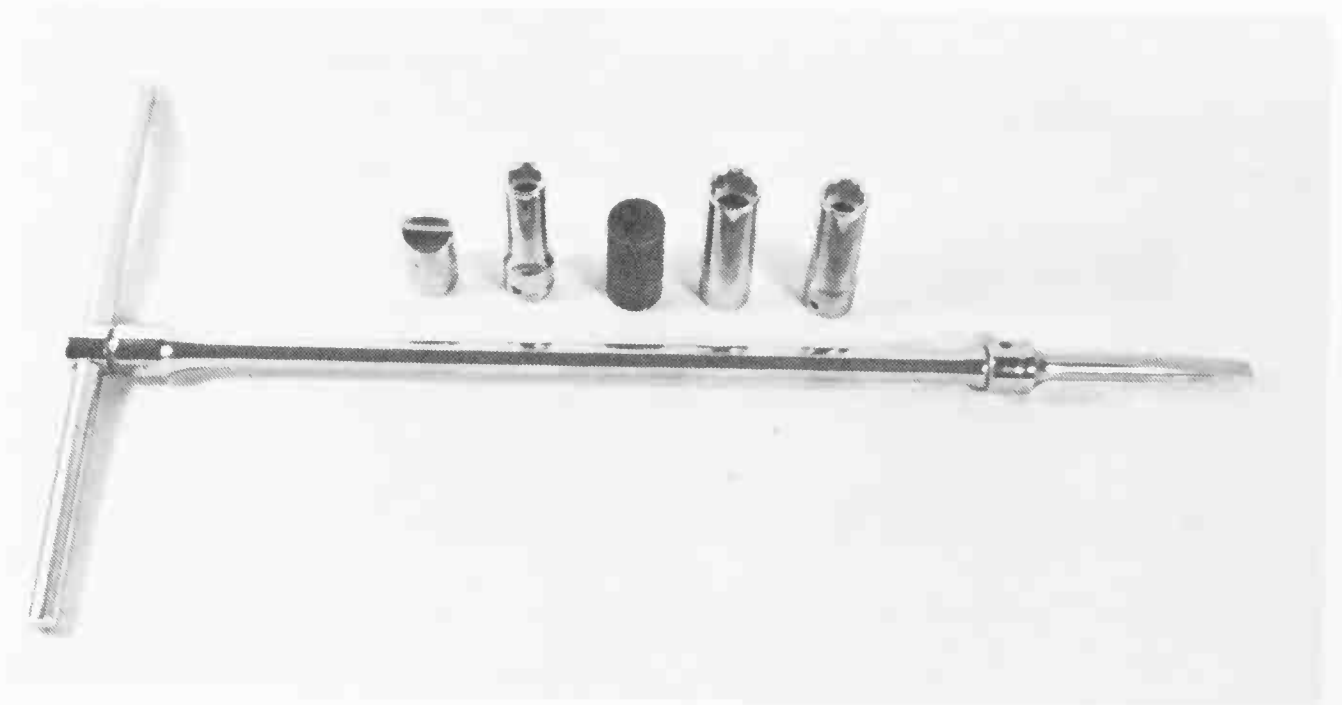


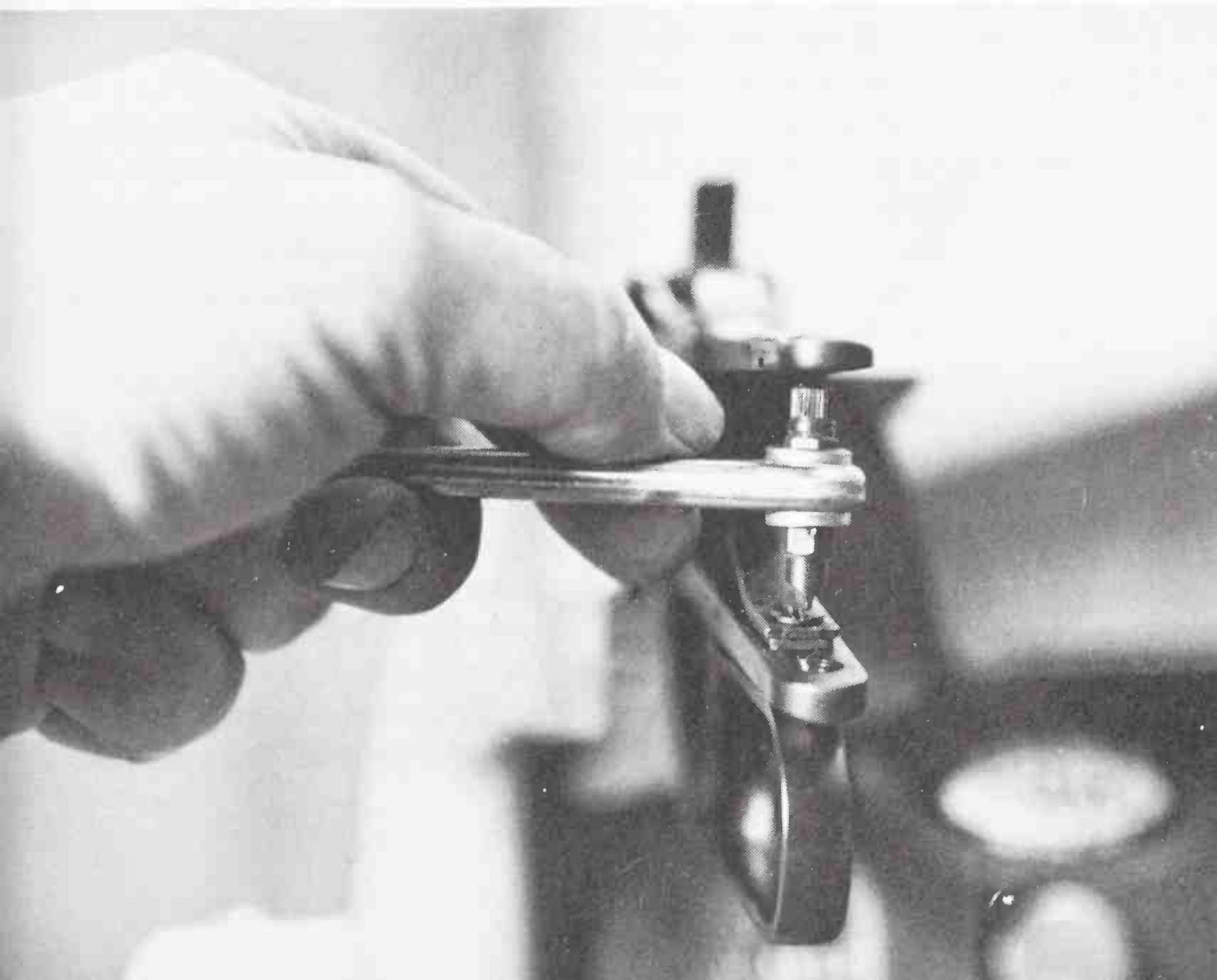
Fig. 5-24. Brownell's Stock Take-Down Tool Kit is designed to handle any and all stock take-down problems.



Brownell's Stock Take-Down Tool Kit is designed to handle all stock take-down problems. The socket heads are correct to prevent slipping and burring. The drag link bit and socket screwdriver are round at the socket end which automatically centers the blade in the stock bolt hole and makes fitting it into the slot much easier than when using a conventional screwdriver. This set is expensive, but when you need it, nothing else will do. There are also other uses for it in gun work, so it will give multiple service for the investment.

Another hair-pulling problem is trying to loosen or tighten a screw in close quarters, such as the trigger spring screw in some break-open, single-barrel shotguns. The receiver tangs prevent a direct approach using conventional screwdrivers, and you usually wind up bruising knuckles and botching screw heads. A midget offset ratchet, such as the one in figure 5-25, will help tremendously. The short 18-degree working arc is unbeatable for removing screws in close quarters. The ratchet direction reverses instantly by turning the tool over. It can be used with several types of screwdriver bits, but it is recommended for use with the Chapman screwdriver set.

**Fig. 5-25.** A midget offset ratchet is unbeatable for removing screws in close quarters.



## BENCH BLOCK

When trying to remove drift pins from various gun parts, you will discover that it is difficult to position the part solidly to take the blow, and still provide an escape area for the drift pin to come through. A bench block will give a means to easily remove the drift pins from practically any weapon without any damage to the gun or the pin itself.

To make a bench block, cut a scrap of 2-inch-by-4-inch lumber to a 6-inch length; sand all edges smooth. Lay out and mark the groove and retrieval pocket. Make several saw cuts within the margin of the groove layout lines, then finish cutting to size with a wood chisel. Use a tight-fitting sanding block with sandpaper, and smooth all edges of the groove. Make diagonal saw cuts for the retrieval pocket and remove the remaining wood with a wood chisel. A  $\frac{1}{4}$ -inch drilled hole will complete the project.

You may want to fill the pores of this wooden bench block and then varnish it to prevent the wood from soaking up the oil that drops off the various gun parts. To do so, sand smooth, apply wood filler, and resand to bare wood after the filler is completely dry. Apply another coat, and when dry apply a coat of spar varnish. When the varnish is dry, rub the block lightly with fine sandpaper. Apply another coat of varnish very evenly. When this final coat is dry, the bench block is ready for use.

The dimensions given for this bench block are flexible. If another size would serve you better, change them. For example, a piece of 4-inch-by-4-inch lumber may be better. In this case, other dimensions will remain the same, except that the  $\frac{1}{4}$ -inch hole from the groove to the retrieval pocket will be longer, enabling the block to handle longer drift pins.

This bench-block project is relatively simple, and many may be tempted to do the work without taking too many pains. It will probably work just as well, but it is a good idea to get into the habit of doing nothing but the finest work, even on the simplest of projects. I once was given the job of refinishing an entire gun collection that had been slightly damaged by a small fire in the owner's home. After the work was completed, the owner admitted that he had been reluctant to entrust the entire collection to just anyone. But after he happened to notice the fine work that I had put into a simple block of wood on my bench, any doubts he had vanished. If I took that

much trouble with a block of wood that made little difference, he reasoned, I must really do fine work when it counts.

## TIME-SAVING DEVICES

A skilled gunsmith can turn out a large amount of work with only a few hand tools. However, few professionals rely solely on hand tools; most have shops equipped with loads of special tools to make the work go easier and faster.

Power tools can also help the hobbyist turn out certain gun repair jobs faster, but few part-time gunsmiths can afford to invest in a large array of power tools. A good lathe, for example, could cost \$3,500 or more, and a milling machine about the same amount. If you add accessories, the amount can quickly double. But face it, eventually every serious hobbyist is going to wind up with some power tools. The main objective is to be selective and not waste money.

### *Plan Before Purchasing*

The purchase of any good power tool is going to require a relatively large cash outlay, so careful planning is necessary to stretch your dollar the farthest. A piece of equipment that will stand idle in your shop is not a good investment. Don't, for example, buy a drill press just because another gunsmith has one. The majority of that gunsmith's work may consist of mounting telescope sights on rifles, in which case, the drill press is almost indispensable. On the other hand, if your work consists mostly of blueing firearms, a power buffer to polish the metal parts prior to blueing would be a better investment. By the same token, if you specialize in making small replacement parts for obsolete firearms, a milling machine and a small, inexpensive lathe would be a good investment. Before purchasing any expensive power tool, be sure you have a need for it.

Once you decide that a certain power tool would be beneficial to you, begin gathering all the information available about the various types on the market. Look through tool catalogs, compare capabilities and prices, and then decide which model suits your needs the best. Compare the specifications of different models. Then ask people who have been using the tool how it performs for them, what they like about it, and what they do not like.



Also keep in mind that the most expensive piece of equipment is not necessarily the best; or it might not be the best one for you. Carefully investigate each piece of equipment, and then decide which one is best on the merits of how it will suit your own needs. To quote John Ruskin, of yesteryear:

It's unwise to pay too much . . . but it's worse to pay too little. When you pay too much, you lose a little money . . . that is all. When you pay too little, you sometimes lose everything, because the thing you bought was incapable of doing the thing it was bought to do. The common law of business balance prohibits paying a little and getting a lot. It can't be done. If you deal with the lowest bidder, it is well to add something for the risk you run. And if you do that, you will have enough to pay for something better.

It would be difficult, if not impossible, to recommend an assortment of power tools to fit everyone's needs. But for hobbyists who will be doing average gun work and for those who eventually want to branch out into full-time careers, the following section lists power tools that might be needed in the recommended order of purchase.

### ***Drill Press***

The first large power tool I purchased for my shop was a drill press and stand, and it has paid for itself time and time again. Besides its obvious uses—drilling holes in metal for mounting sights and such—the press enables me to do precision jewelry on gun bolts and other parts, makes sling swivel installations a snap, and aids in inletting stocks when a Forster wood bit is used in the chuck. In fact, after I used the press for a while and learned to use the various accessories, I wondered what I ever did without it.

If a good drill press is too expensive at this time, do not bother buying an inexpensive one that will not bore true holes or handle the work. Instead, purchase a press that will attach to a hand drill motor and make this do until you can afford a better drill press.

The accessories for drill presses are numerous and permit all sorts of jobs to be done on the press. For example, when drilling a hole in metal to be tapped, a B-Square Tru-Tapper will help you

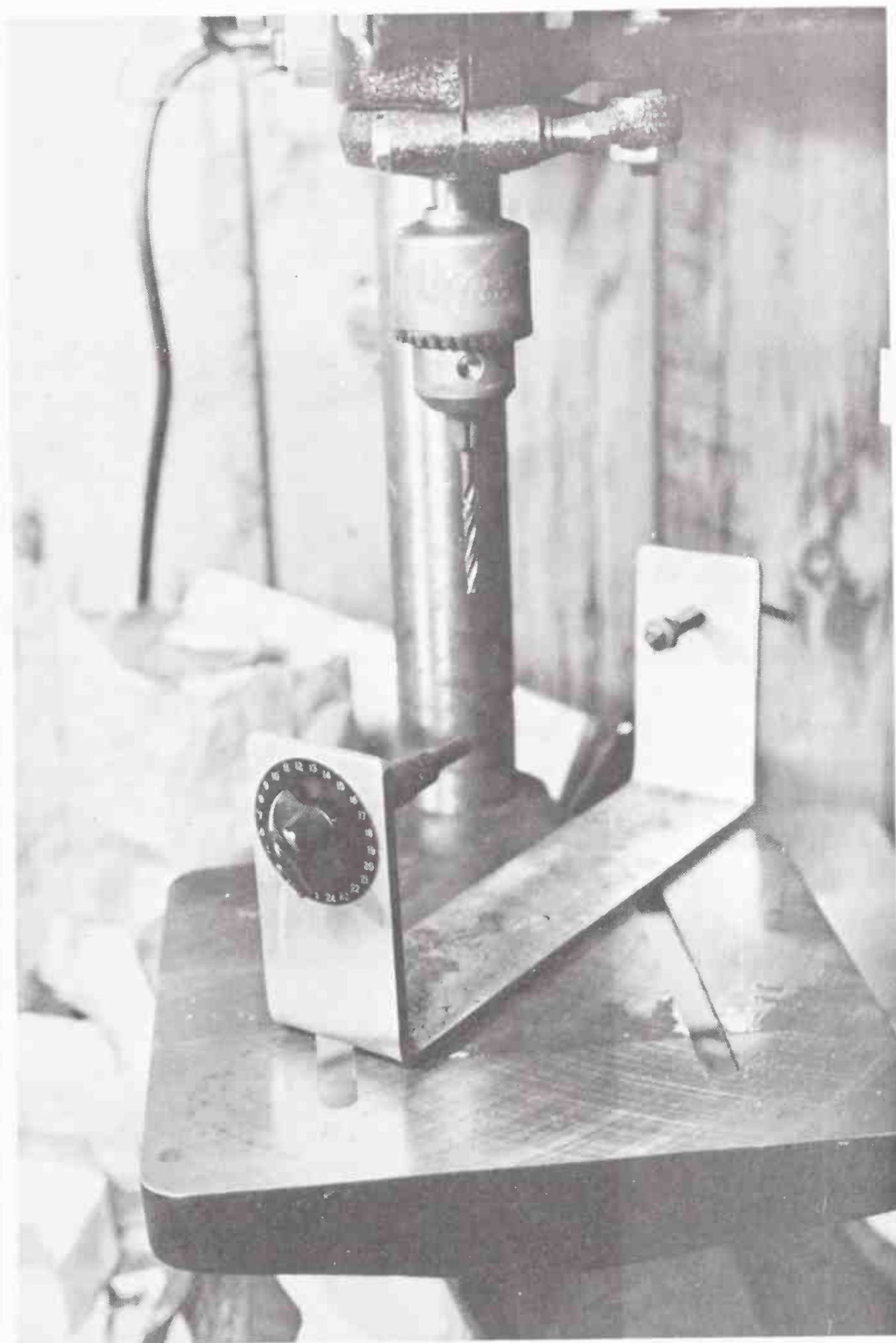


Fig. 5-26. B-Square-brand jewelers' fixture used in conjunction with the drill press to jewel bolts and other metal parts.

make straight threaded holes because it is held true in the same chuck that drilled the hole. Its use eliminates the need for tap guide bushings and other cumbersome items. To use, just drill the hole and replace the drill bit with the Tru-Tapper. The wrench revolves and slides up and down on a ground spindle to accurately guide the tap. Comfortable ball handles allow complete control of the tap. Besides guaranteeing straight threaded holes, the device will also help eliminate tap breakage.

To make or sharpen screwdriver blades to fit any gun screw exactly clamp a B-Square Blade Maker to the drill press to hone the blades for precision hollow grinding. Insert a grinding stone into the chuck of the drill press, and lock the screwdriver shank into the B-Square Blade Maker. The blade maker assures parallel blade faces and blade tips.

You can also turn a drill press into a milling machine with a B-Square Milling/Drilling Table. The table with vise fastens to the center hole in the drill press table and is constructed of heavy cast iron and steel. This device can be used for milling gun parts when cutters are chucked into the drill press, as well as for scope mounting and jewelers work. The adjustable gibs have a 5-inch travel in both directions and .001 graduated dials, and the table rotates 360 degrees.

Other accessories are available for a drill press that will enable you to perform many jobs around the home, such as building furniture. For example, a mortising package can be used for drilling square holes for precise, invisible joinery. With a special router chuck and router bit, the drill press becomes a precision router for fluting and dovetailing. Drum or sanding flutter sheets turn the press into a sander for getting into those hard-to-reach places.

If the press tilts for angle drilling, you can chuck an arbor into the press, and attach buffing wheels for polishing gun parts prior to blueing or wire wheels for carding during the hot water method of blueing. Swing the table away from the spindle, tilt the spindle out for accessibility, and you are in business.

### ***Small Lathe***

Many experts would recommend a bench grinder as the second power tool for the home gun shop. It is a very handy tool to have around. But since an inexpensive grinding wheel can be purchased



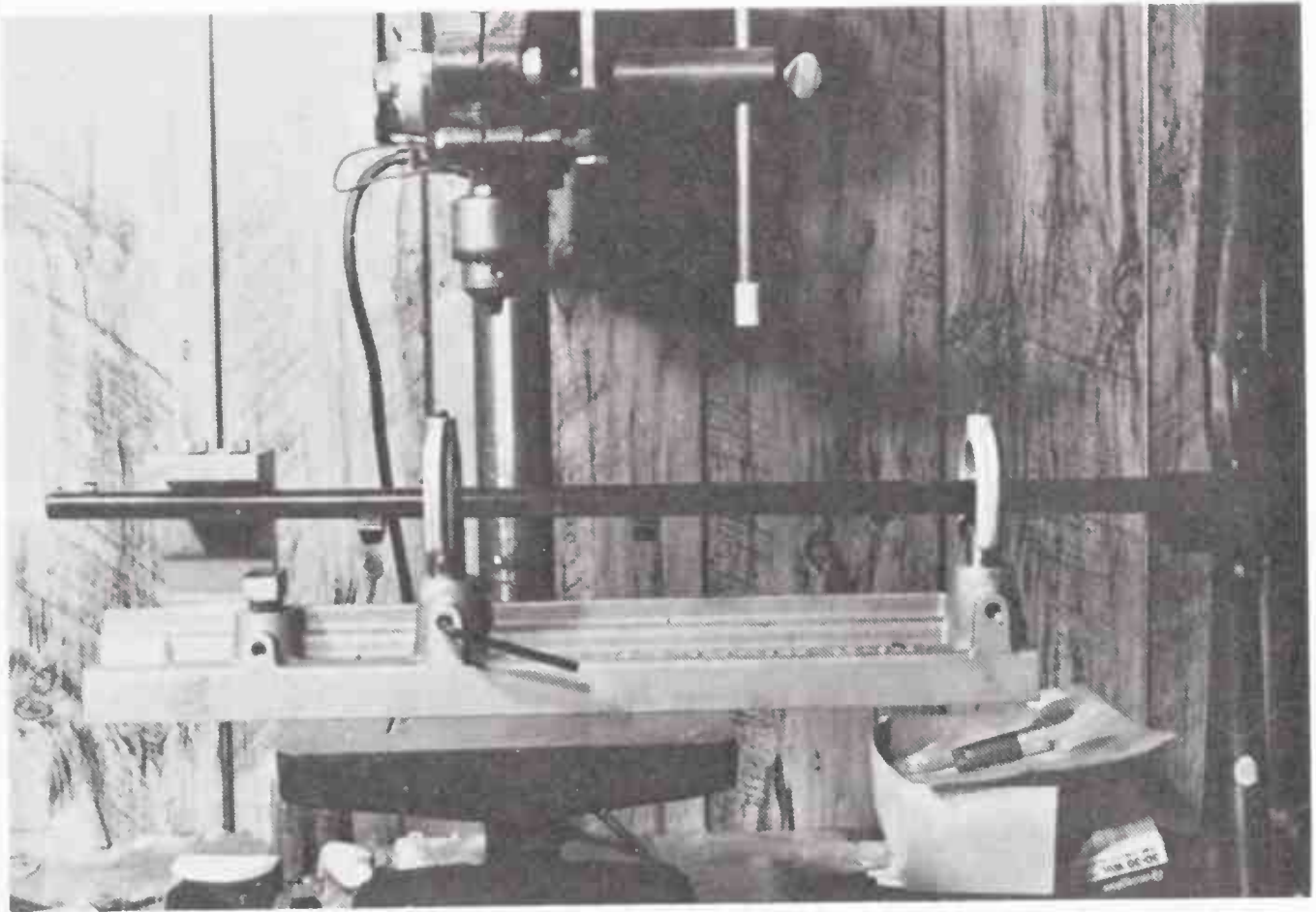


Fig. 5-27. Universal sight jig set-up on drill press table ready for drilling holes for scope mounting.

for use in either the drill press or a small lathe that will accommodate most of the grinding operations encountered, a small bench lathe is recommended here instead.

While you eventually will want to get a larger lathe with a 9-

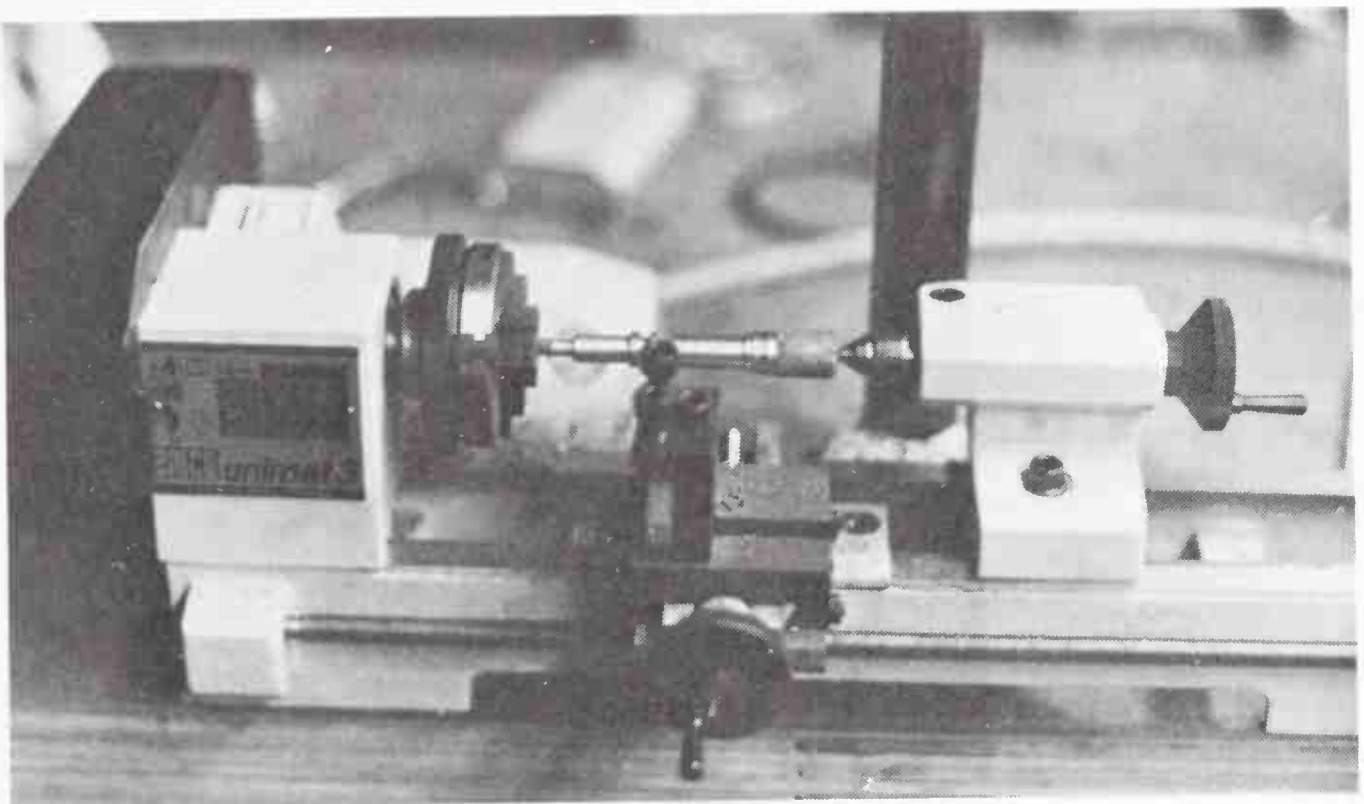


Fig. 5-28. Unimat 3 lathe set up for turning firing pin.

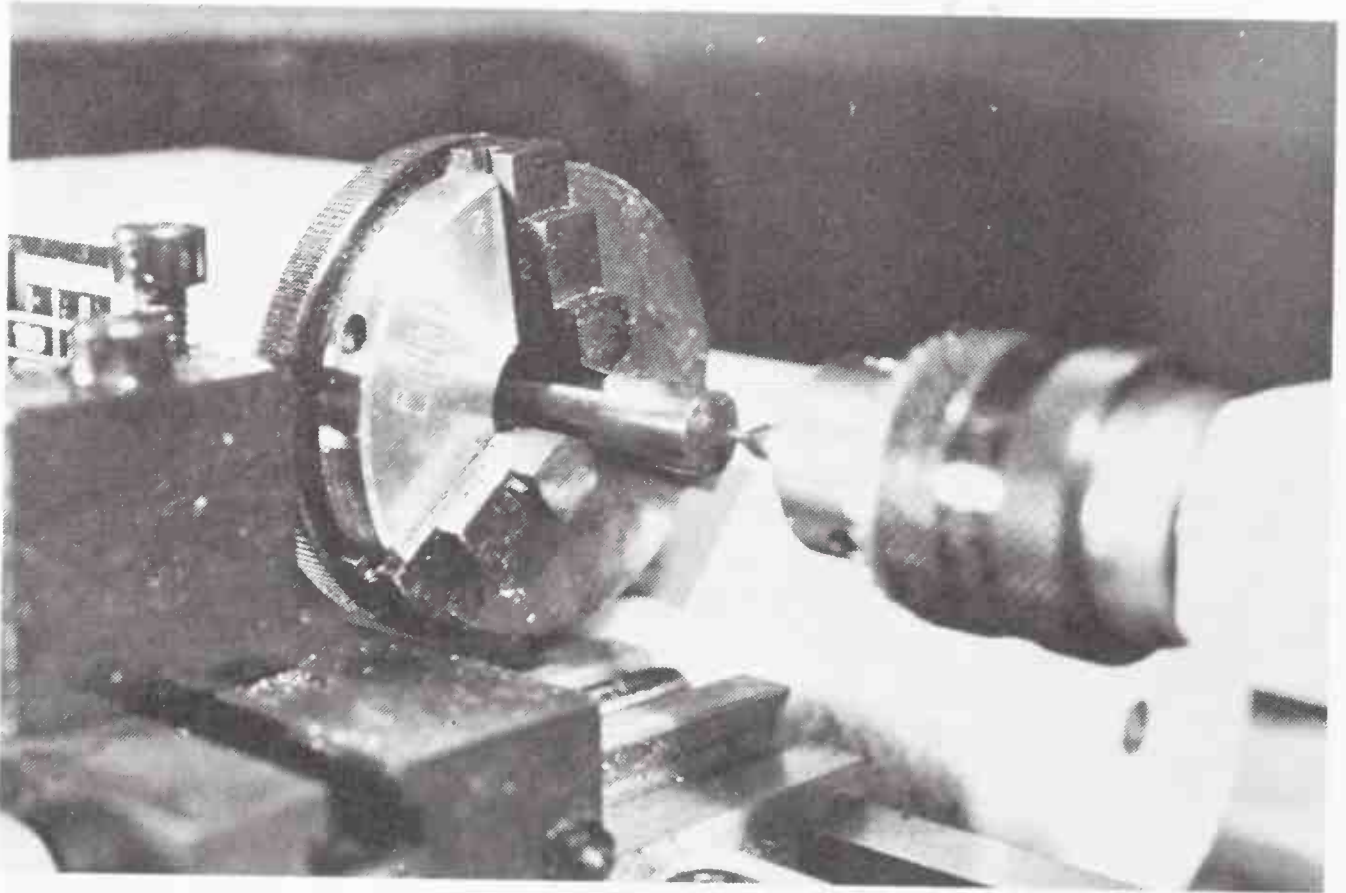


Fig. 5-29. Workpiece in 3-jaw chuck of the Unimat 3 with countersink drill about to mark center.

or 12-inch swing and 36 inches between centers, a small lathe, such as an Atlas or Unimat 3, is all that is needed initially. Gunsmiths say that the Atlas lathe with about 20 inches between centers is hard to beat in both price and performance. As I have not had a chance to try one, the Unimat 3, which I have used, is described here.

At first glance, the EMCO Unimat 3 appears to be a toy, but nothing could be farther from the truth. Although small in size, it is an authentic, scaled-down version of the real thing—a universal machine for longitudinal turning, taper turning, thread cutting, drilling, milling, dividing, grinding, cutting, polishing, sawing, wood turning, planing, and routing. The Unimat 3 will turn out firing pins, drift pins, and similar small parts all day long without tiring. For a little extra money, a vertical drill and milling attachment can be added that will perform all sorts of jewelry, drilling, and milling. But do not expect the machine to perform as fast as the larger ones. Take your time and you will be able to turn out precision work.

One attachment that is recommended is the collet for holding drills, milling cutters, and round workpieces when the highest accuracy and concentric running are demanded. This attachment is



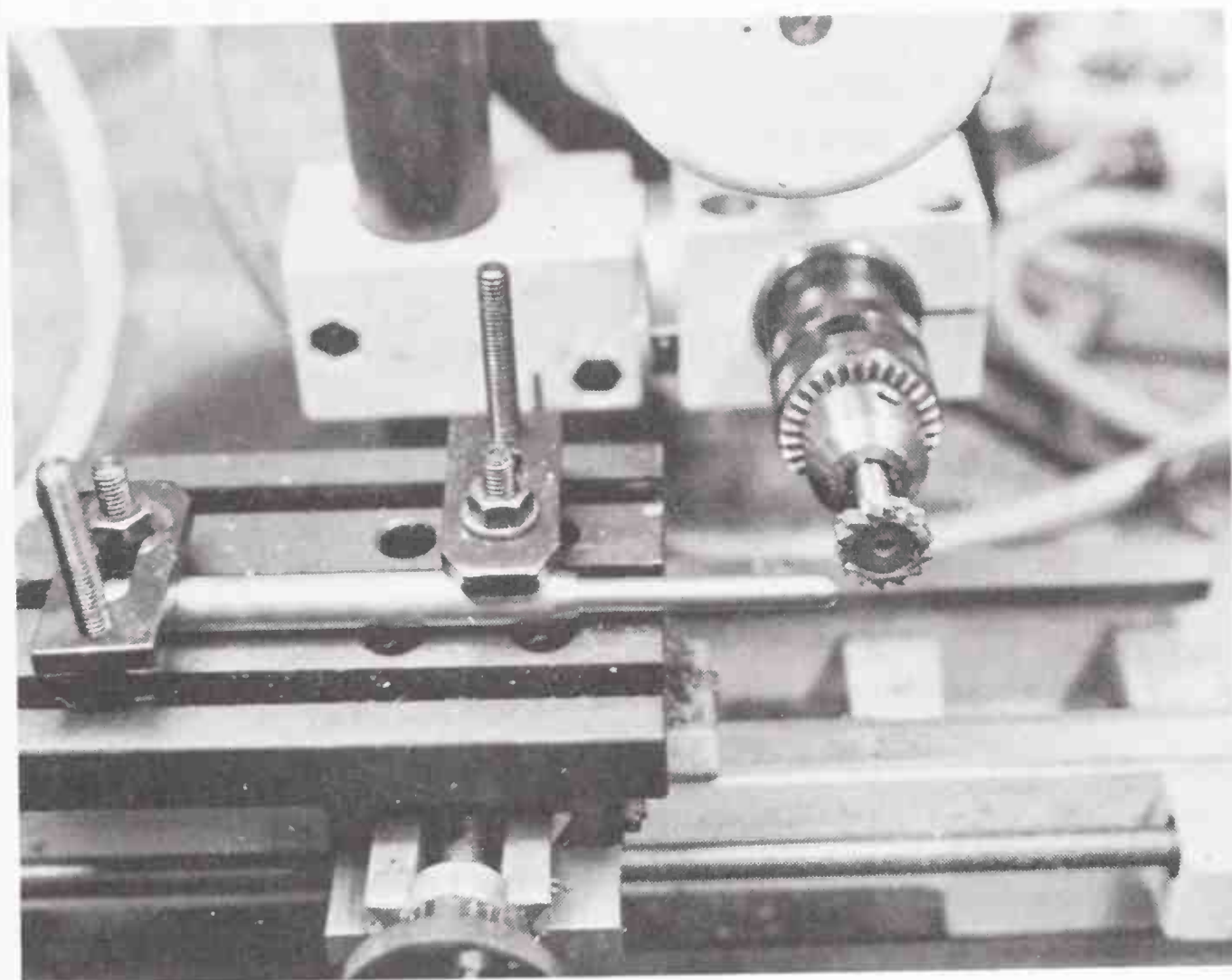


Fig. 5-30. Unimat 3 in milling position finishing up a .22 rim-fire chamber "ironing tool."

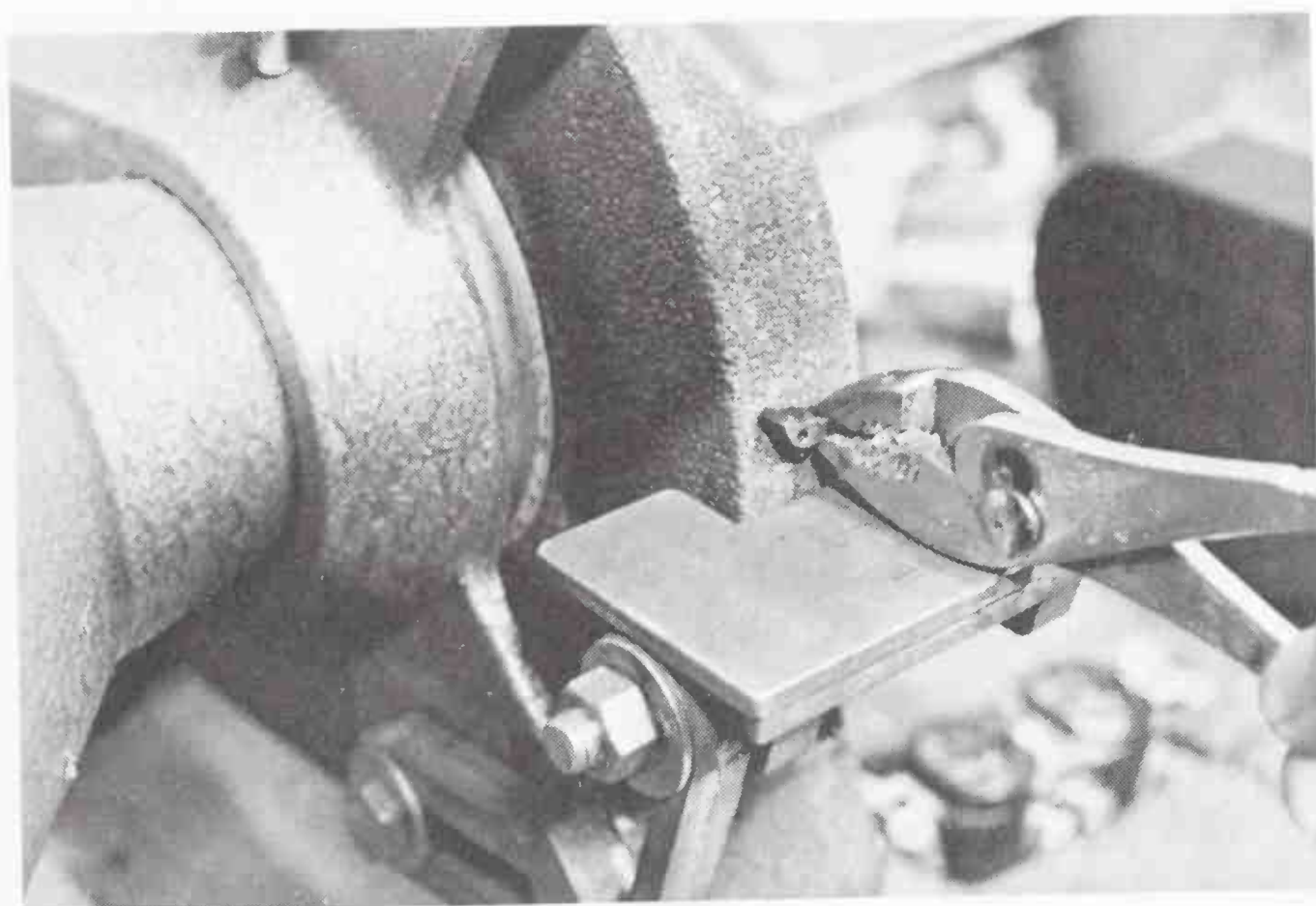


Fig. 5-31. A bench grinder removes a lot of metal quickly and is excellent for such purposes prior to final finishing.



fitted onto the spindle nose by means of a specially machined flange. Ten collets for gripping diameters of 1/32 inch to 5/16 inch in steps of 1/32 inch are available.

Once you learn to use the lathe, you will be able to make many other tools and accessories with it, including headspace gauges, and chamber-ironing tools. You will be able to mill an occasional trigger guard or hammer, but be prepared to spend several hours on each. The 3.6-inch swing over the bed makes it possible to center most .22 rim-fire bolts between the head and tail stocks, with enough room for the bolt to turn without hitting the bed. A bolt-facing lathe bit can then be used to open up the bolt face as required.

### ***Bench Grinder***

A bench grinder will mainly be used to sharpen tools and drill bits and maintain the other tools used in gunsmithing work. It will also grind down metal surfaces rapidly and is excellent for such purposes prior to final finishing with a file or polishing wheel. With one or both grinding wheels removed, buffing wheels can be attached to the arbors to polish metal surfaces for gun blueing. Or, when wire

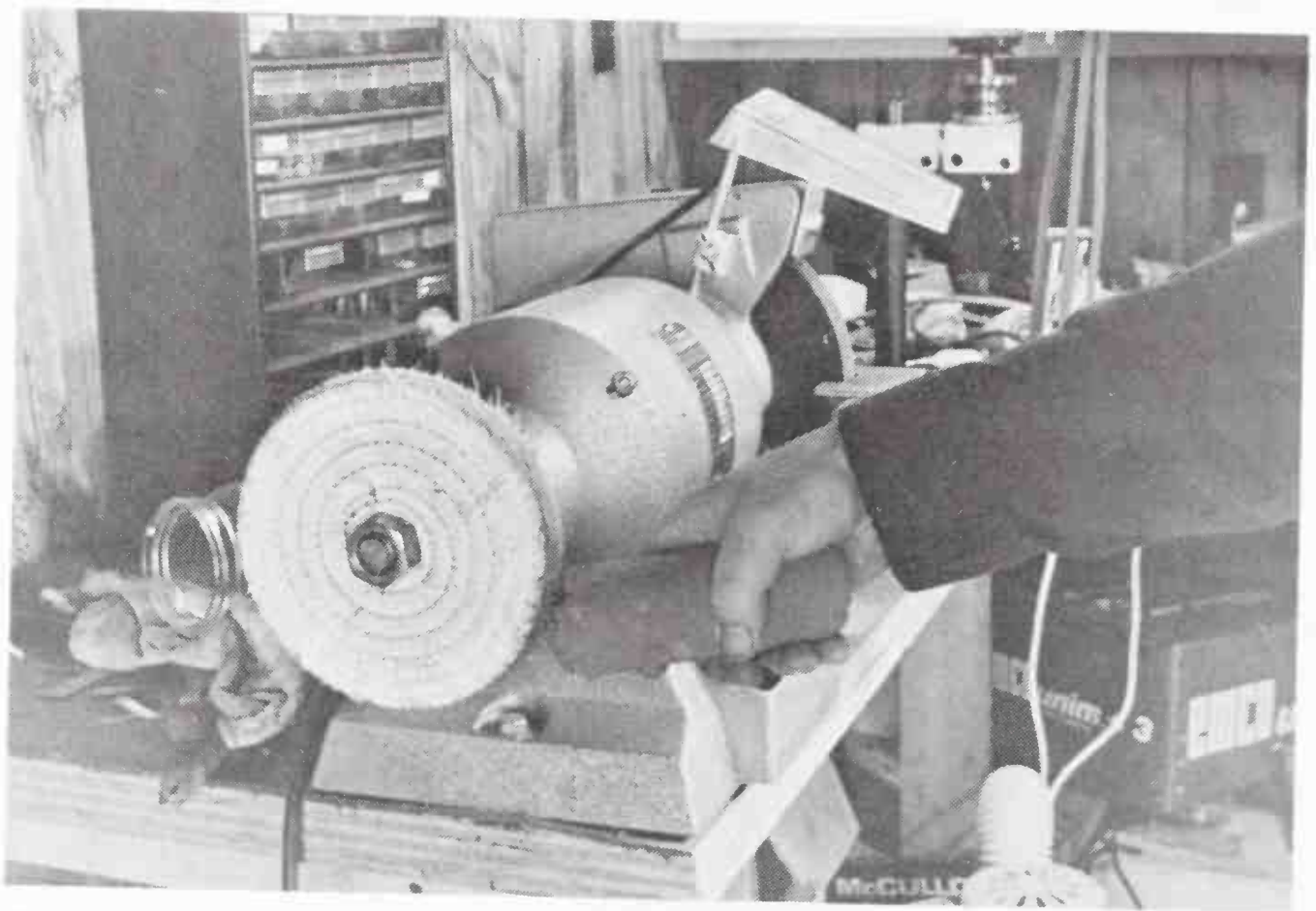


Fig. 5-32. One of the grinding wheels has been removed from this bench grinder to convert it to a polisher.

wheels are used, it is possible to card metal surfaces when using the hot-water method or slow-rusting process of gun blueing.

### ***Welding Outfit***

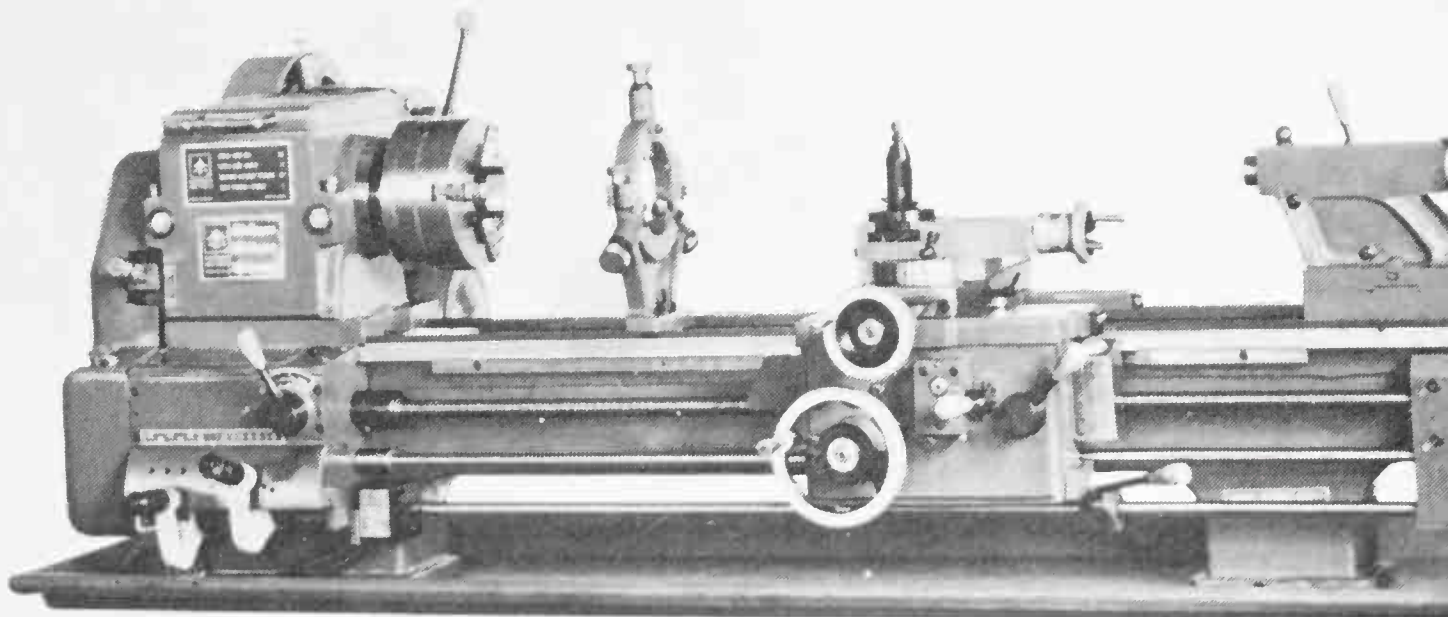
Although it is not really a power tool, an oxy/acetylene welding kit to use for welding, silver soldering, brazing, and heat treating parts should be the next purchase. Heating and bending or welding bolt handles is just one job the welding outfit will perform. There are countless broken parts for which replacements are not readily available that can be mended with a welding outfit and silver solder.

### ***Lathe***

When selecting a lathe for gunsmithing work, the most important consideration is the size and amount of work that it will be used for. The lathe should be large enough to accommodate the various classes of work that will be handled. This is determined by the greatest diameter and length of work that will be machined in the lathe.

If you anticipate many conversion jobs which require barrel turning, bolt facing, and chambering and threading of barrels, then you will need a lathe like the JET Model 1236p Bench Lathe. Each lathe, however, has advantages and disadvantages, and the final decision to purchase one should be made only after you have thoroughly and candidly analyzed your abilities and your anticipated specialty, and your probable future desires.

**Fig. 5-33.** Jet Engineering 1236p Bench Lathe is ideal for most gunsmithing work.



Milling attachments are also available for most lathes that will do a great deal of milling in the gunshop. The milling cut is controlled by the hand wheel of the lathe carriage, with the cross-feed screw of the lathe and the vertical adjusting screw at the top of the milling attachment.

### ***Milling Machine***

A milling machine can be a worthwhile investment if the shop is engaged in making a lot of gun parts from patterns or duplicates. By today's standards, a milling machine is really not too expensive,

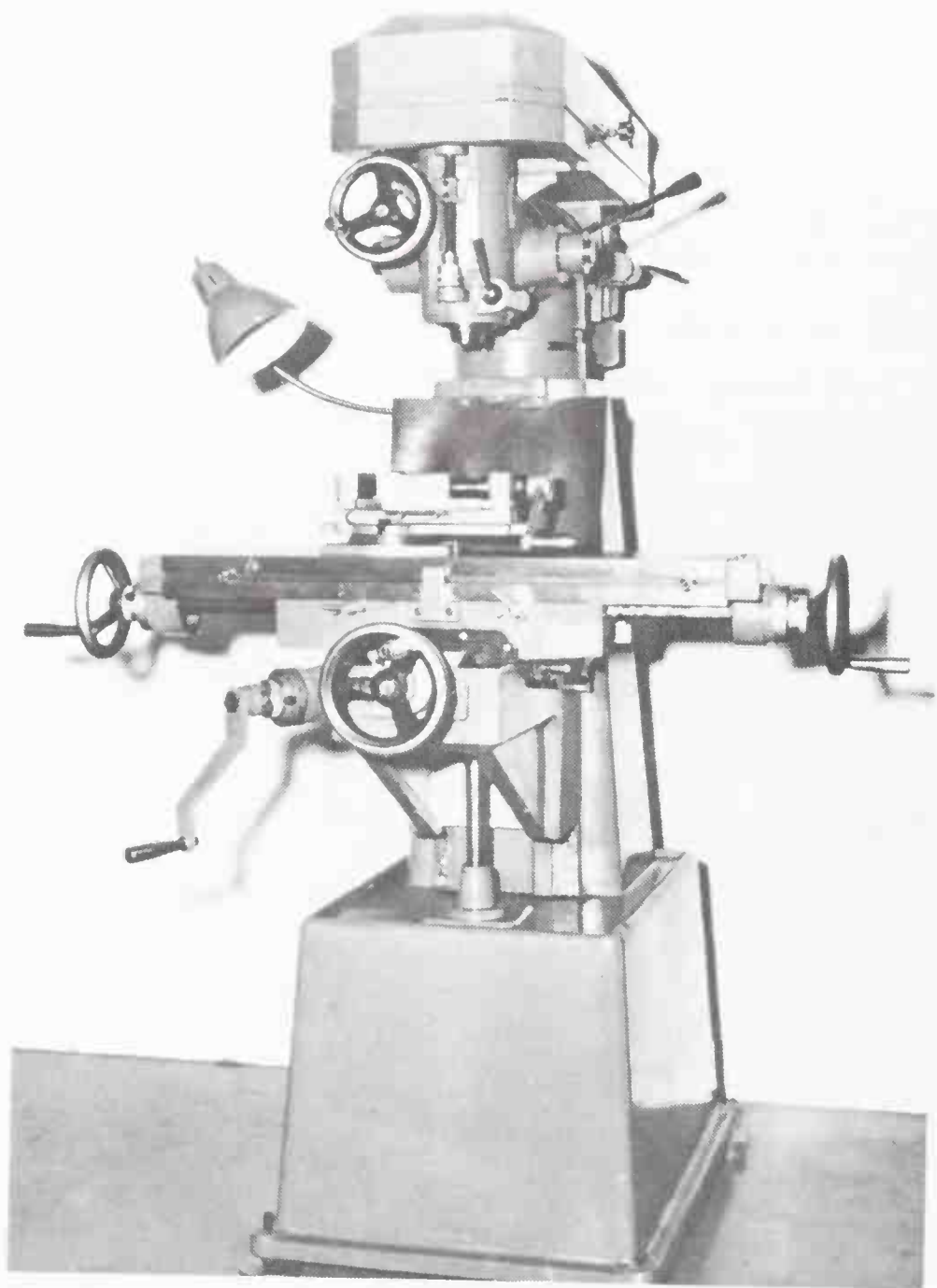


Fig. 5-34. This milling machine would be an asset to any gunshop.



but the machine itself is only part of the story. When several milling cutters are required (and they usually are), the investment is quite large.

In general, a milling machine is designed to cut metal by means of a multitooth rotating cutter. The machine is constructed in such a manner that the workpiece is fed to a rotary cutter instead of a fixed cutter being applied to a rotating workpiece, as on a lathe.

The milling machine shown in figure 5-34 is ideal for the gunshop because it is also a complete drill press. Almost any small gun part, including a receiver, can be machined on this tool. In fact, the milling machine was developed for use in gun factories. A seasoned operator can use the machine to make all sorts of replacement parts for firearms or to make complete firearms.

### *Heat-Treating Furnace*

There is one tool that deserves mentioning—the heat-treating furnace. Several types are available in a wide price range. The Hup-

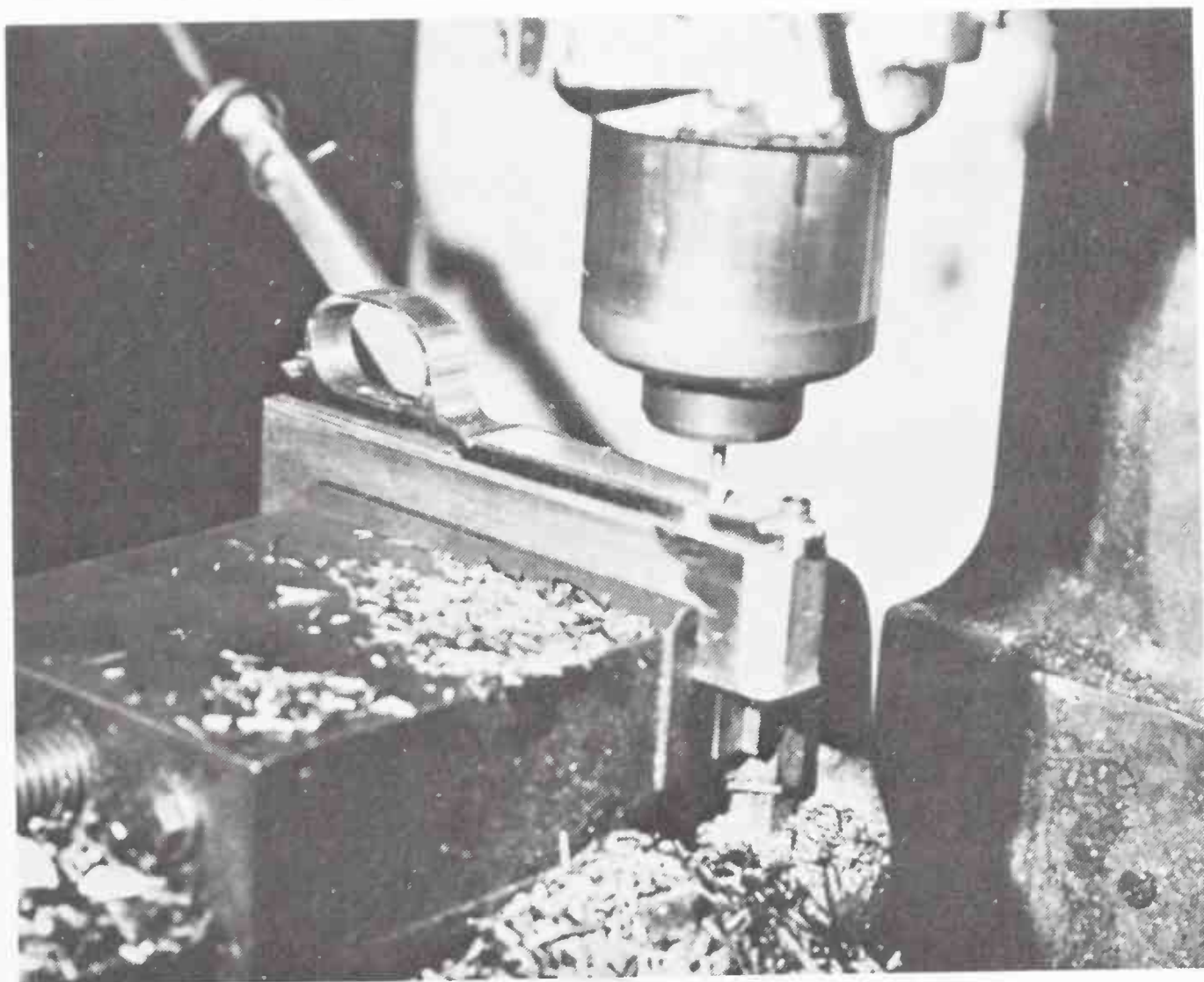


Fig. 5-35. One-piece trigger guard for Winchester Model 70 (pre-1964) being machined on milling machine.

pert Electric Heat-Treating Furnace, available from suppliers of gunsmithing tools, is designed specifically for precision heat-treating in gunshops. It is simple to operate and service.

The gunsmith who makes tools and parts, such as firing pins, drift pins, sears, reamers, and springs, will have to harden them correctly. Many use the color method of hardening in a gas flame, but the process cannot be controlled this way. The odds against obtaining the correct hardness every time are high. Therefore, for the shop that turns out a lot of this work, an electric furnace is a good investment.

For removing parts from the hot furnaces, one or more sets of tongs are necessary. Special tongs, available from Frank Mittermeier, Inc., are specially designed for handling small parts in heat-treating furnaces and are highly recommended. They are made from  $\frac{1}{4}$ -inch stock and are about 16 inches long. Insuring a positive grip on various objects, they permit the operator to handle parts easily from a distance.



Fig. 5-36. MMC Power Checkering Tool can speed up the checkering operation once the user becomes familiar with its operation.



### ***Miscellaneous Power Tools***

With the addition of a barrel vise and wrench, the experienced craftsman who has the tools mentioned will be able to handle almost any type of work encountered in the operation of a gunshop.

A look through any gunsmith supplier's catalog reveals a large array of gunsmithing tools that have time-saving capabilities. For example, electric checkering tools will speed up the process of checkering once you have practiced enough to use the tools correctly. Power buffers by Baldor or B-Square speed up the polishing process prior to blueing firearms. As a gunsmith, you might get into reloading ammunition, developing new wildcat cartridges or new loads for factory cartridges. In which case you may want an electronic chronograph and maybe even a pressure gun to check the chamber pressure of your reloads.





# **Materials and Supplies**

GUNSMITHING SUPPLY CATALOGS contain hundreds of solutions, compounds, and other materials related to gun work. It would be impractical to buy all of them, so stock up on the materials you will be using the most and purchase others as the need arises. This is easy to do if you work only on your own guns, since it is simple to determine what work you will be doing in the near future. If, however, you work on other people's firearms, either full-time or part-time, it is a different story altogether. Estimate your needs in advance so customers will not have to wait any longer than necessary.

While an individual's needs will vary from person to person, the following list of materials and supplies are the recommended ones for outfitting a shop from scratch. Do not let this list dictate your needs. If you feel that something is missing, buy it. Should a particular item seem unnecessary, then omit it.

Unless otherwise noted, all materials are available from Brownell, Inc. A request for their catalog will give current prices and ordering instructions.

## **ABRASIVES**

The uses for steel wool around the gunshop are many: removing rust, polishing, burnishing, cleaning, finishing, touching-up with cold blue, carding when using the hot-water method, and scouring. Most sizes of steel wool found at the local hardware store are too coarse for gun applications. Obtain a pack of steel wool pads in 0, 00, 000, and 0000. For scouring, obtain sizes 1, 2, and 3.

Many uses will be found for abrasive cloth in grit sizes #100, #150, #240, #400, and #600, including stock work, hand polishing metal surfaces prior to blueing, removing high spots on metal and wood. Gritcloth is becoming very popular with professional shops where hand sanding or polishing is done. It is composed of hundreds of thousands of abrasive particles that keep cutting up to fifteen times longer than any other abrasive cloth. And it cuts faster too. For finishing gunstocks, Gritcloth cuts off the whiskers rather than pressing them inward as partially loaded sandpaper often does. Furthermore, Gritcloth will remove old finishes from gunstocks without a trace of filling or loading from the old oil or varnish.

Flex-I-Grit, a tough mylar sheet impregnated with fast-cutting abrasive, can be bent, folded, creased, and soaked in water or solvent and still keeps on cutting or sanding. When you think the sheet has had it, try washing it with soap and water. Chances are the sheet will be as good as new. Users claim that this type of abrasive cloth will last up to nine times longer than conventional sheets, yet it sands every possible contour or configuration without peeling, cracking, or tearing; wet or dry; and without staining the work. It is perfect for final finishing of gunstocks and for hand polishing metal gun parts prior to blueing.

Now, do not go out and buy great quantities of these abrasive papers and cloths. Everyone has different preferences in the way of tools and materials. Therefore, try a few sheets of each type of abrasive cloth and then settle on the one (or ones) you like the best. Or keep small amounts of the different types on hand for various uses. For example, use No. 0 aluminum oxide finishing paper for the



first cutting on a stock refinishing job if the stock is badly scarred, and then go to Gritcloth, and finally to the finest grades of Flex-I-Grit for final finishing.

## **FINISH REMOVERS**

A lot of work and time can be saved when refinishing wood and metal parts on firearms by using a finish remover before sanding or polishing. TM-4 Finish Remover removes lacquer, varnish, paint, oil, and some two-part epoxies from wood, plaster, glass, and metal. To remove most finishes, spread the solution on the surface with a natural bristle brush and wait about twenty minutes. After the finish softens, wipe it off with a wet towel or wet burlap. When removing finish from checkered areas, use a small stiff brush and plenty of water. Scrub lightly until the TM-4, finish, and water combine to form an emulsion. Remove this with water.

Epoxies and very thick gunstock finishes may require a second coat after about thirty minutes, as well as some light scraping. To remove stains from wood, let the TM-4 stay on the wood for about one and a half hours. Then use a stiff brush and water to make an emulsion, and wipe the surface clean with a rag or sponge.

For heavy oil finishes like those found on old military weapons, about one cup of Mr. Clean and a half cup of Clorox to a gallon of hot water will do wonders. Use a stiff cleaning brush and scrub the stock with the hot cleaning solution for about five minutes. Then heat the stock over a hot plate or similar source to dry it, but be sure not to let any of the wood get so hot that it becomes scorched. Wipe off any linseed oil that may have bubbled to the surface, and de-whisker the surface with fine steel wool. For stocks in not-too-bad condition, about three applications are all that is necessary. However, some rough military stocks could require as many as twenty or more applications to get all of the oil out of the stock.

Brownell's Rust and Blue Remover removes the rust and old blue from firearms prior to blueing. It comes in concentrated form and is mixed about one part solution to one part water. The remover is designed to attack only rusted steel, providing immersion is not unreasonably long—several hours. The rust and old blue will be completely removed, leaving nothing but the bright steel. Follow the directions printed on the label attached to the bottle.

## **SHELLAC STICKS**

For repairing dents, scratches, and deep tool marks, shellac sticks are preferred by professionals. They are available in white, ivory, transparent, medium walnut, light transparent, light walnut, dark walnut, circassian walnut, and black.

Begin by cleaning the area to be repaired. Heat the pallet knife blade with a propane torch until it melts the shellac when pressed against the end of the stick. When a small amount of the melted shellac is on the blade, immediately wipe it across the area to be repaired. This is best done by turning the blade and then, holding the knife at a 45-degree angle, drawing it over the dent, scratch, or what have you. Your motion should be quick, yet gentle, and if you fail to fill the dent on the first pass, repeat until you do.

After the shellac has thoroughly hardened—which will take only a few minutes—sand down the area so that the fill is flush with the stock. Then finish the repaired area the same as you would finish the undamaged areas of the gunstock.

## **ABRASIVE COMPOUND KITS**

Lapping parts to remove surface roughness, smoothing out bearing surfaces in gun actions, barrel crowning, and similar work requires a variety of grit sizes in a paste form. There are dry-powdered abrasives in 120 to 600 grit that require mixing with oils before use, but you will be money ahead by buying those already mixed such as Clover Compound. These abrasives are formulated with a special grease base that lasts a long time and does not break down under heavy use. These compounds remove metal fast and are ideal for nearly all fitting and lapping operations. A kit is available that contains six sizes from 120 (coarse) grit to 800 grit (micro fine).

## **HARDENING COMPOUNDS**

As parts for obsolete guns become harder to find, professionals and hobbyists will have to manufacture more parts to replace those that have become lost, broken, or worn. In doing so, parts that are subject to wear will have to be hardened. One easy way to accomplish this is to use Kasenit Surface Hardening Compound for case-hardening plain carbon or low carbon alloy steels. The compound carburizes surfaces quickly to uniform depth, giving a hard-wearing

surface while retaining the toughness of the core. It is nonpoisonous, nonexplosive, nonflammable and is excellent for hardening firing pins, drift pins, sears, punches, and other small metal parts having a low-carbon content. Brownell Hard-N-Tuff works in a similar way.

## **CLEANING PADS AND SWABS**

Clean rags and applicators are often needed at the bench. There are commercial suppliers who, each week, will leave a specified quantity of cloths and pick up the dirty ones to be washed and cleaned. This is very convenient, but gets expensive.

Brownell Cleaning Pads cost only pennies apiece and are ideal for all kinds of wipe-on and wipe-off jobs around the shop. These 100 percent nonwoven cotton pads are completely lint-free and clean and will not scratch delicate surfaces. This can be used on sights, optics, and lenses without damaging them. They come in bags of one hundred. Keep a couple of bags on hand.

When I began blueing firearms by the hot-water method and by the slow-rusting process, I used a pair of needle-nose pliers to hold a clean cotton ball to apply the blueing solution. This method worked fine except that some of the solution would eventually get on the jaws of the pliers and rust them. If I oiled the pliers the oil could get in the cotton balls, and in turn ruin the blueing jobs. I now use a ring-handled dauber-type swab. A cotton-tipped applicator, such as Q-Tip Swabs, is another good applicator for hard-to-get-at spots.

## **MISCELLANEOUS MATERIALS**

Cleaning rods and materials to clean all types of firearms will be fully described in another chapter of this book. Keep a bottle of touch-up blueing solution close by since you will need it on practically every job. Stock-finishing materials are other items that should be considered. All of these are fully described in their appropriate chapters.

## **GUN PARTS**

Every gun that is used to any extent will eventually need a replacement part. For firearms currently being produced, this pre-



sents few problems. Most parts can be obtained from either the manufacturers or their distributors. On the other hand, replacement parts for obsolete firearms are becoming increasingly more difficult to find and, when they are found, are quite expensive. The burden can be lessened to some extent by knowing where to look for the parts, and knowing what dealers (who trade in obsolete gun parts) have available.

Gunsmiths who can furnish replacement parts quickly, and in turn get firearms in working order again, have the most business and seem to have a better customer-dealer relationship. Therefore, it would seem that anyone planning to become involved in gun repair should load up on parts for every weapon, and watch the customers flow in. But this is not the way it usually happens. It takes time and a large amount of working capital to accumulate that many parts. The key is knowing what guns are used the most in your area and what parts on these guns are subject to the most wear or breakage, then "tool up" accordingly.

A person just starting out may be at a loss as to what gun parts to purchase first. Here's a list of gun parts, most of which can be obtained from the gunsmith supply houses, to purchase initially. (See the Brownell catalog for a complete description.)

- Weaver Scope Parts Kit
- Universal Rear Sight Elevator Kit
- Shotgun Sight Kit
- Weaver Top and Side Scope Mount Base Assortment
- Fillister Head Screw Kit
- Sight Base Screw Kit
- Roll-pin Kit
- Firing Pin Kit
- Assortment of spring kits
- Blank Screw Kit

Other parts can be added to this list as the need arises. For example, if you do gun repair work, you will quickly learn to keep a supply of firing pins, cartridge lifters, and cartridge lifter springs for Savage .22 rim-fire autoloaders. Firearms of this type are popular all over the country, and the items mentioned are the ones most likely to give trouble. You will also want to obtain extractor-car-

tridge lifter springs for Marlin .22 rim-fire autoloaders as well as cartridge guide blocks.

Write to the firearm manufacturers and request their catalog of gun parts. In most cases, you will receive an exploded view of the firearm with all parts numbered, and then a reference list or schedule giving the name and price of the part. Besides giving the information needed to order gun parts, these catalogs are valuable reference for assembly and disassembly of firearms.

There was a time when you could phone Winchester Arms or Savage Arms and request gun parts for any firearms currently in production as well as many obsolete guns, and obtain the parts without much trouble. Today Winchester sells all of their parts for obsolete weapons to Numrich Arms Corp. of West Hurley, NY 12491. Numrich is also the northeastern parts distributor for Savage Arms gun parts, and probably more manufacturers will follow this approach to selling gun parts in the future.

When searching for parts for obsolete firearms and if not sure of the names of the parts, make a sketch of the part, or take a good close-up photo, and send it to an antique gun parts dealer. Give as many specifics as possible about the gun in question, such as model and serial number. One of their experts is likely to know what the part is and will be able either to furnish it or to tell the best source for obtaining it. But then again they might not. Some dealers in used gun parts are becoming so independent that it is now impossible to get a personal reply. For example, an announcement in the most recent catalog from Dixie Gun Works, Inc. states:

#### SORRY

Due to our customer-friends sending in two or three hundred or more questions per day and because there appears to be no let up in these questions, we are taking a serious step by announcing that hereafter we cannot answer these. I hope you will be understanding on this point. May I refer you to other local collectors in your home town or you may obtain the information from reference books.

A few of the major suppliers of obsolete gun parts include:

Antique Gun Parts, Inc.  
1118 S. Braddock Avenue  
Pittsburgh, PA 15218

Bob's Place  
Box 283J  
Clinton, IA 52732

Dixie Gun Works  
Highway 51 South  
Union City, TN 38261

Numrich Arms Co.  
West Hurley, NY 12491

Walter Lovewick (Winchester Parts)  
2816 N.E. Halsey Street  
Portland, OR 97232

Stoeger Industries  
55 Buta Court  
South Hackensack, NJ 07606

If you repair guns professionally, you will accumulate a stock of replacement parts for a wide assortment of firearms, and unless you get overstocked on a particular part, hang onto every part. It may remain untouched on the shelf for years, but eventually a gun will come in for repair that requires that exact part.

A good source for parts is often junk guns, which often can be purchased from pawn shops, estate sales, or public auctions. Or try advertising in local newspapers for junk guns. There are thousands of damaged and abused firearms in attics, closets, and basements all over the country. The owners might want to part with them, but not realize a market is available.



## **Sight Work**

IT IS SIMPLE to mount a telescope sight on a modern rifle that has been drilled and tapped at the factory, provided, of course, you know how to go about it. However, too many people merely purchase a mount at the local discount store, install it on the rifle as tightly as possible, sight the rifle in, and go banging away. Chances are, after the second or third shot, the scope mount loosens and goes unnoticed until you miss that prize buck at only forty yards. A dedicated hunter friend, who is an excellent shot, once killed a deer at nearly a quarter of a mile with a Remington Model 760 in .30-06. However, a few months ago he aimed at a whitetail at less than thirty yards and missed the deer completely. As the buck ran off, the hunter shot at the deer two more times before it ran out of sight. These bullets cut small twigs from trees near the deer, but all three shots cleanly missed. After settling down somewhat, he checked his scope. Sure enough, it was loose and out of alignment.

## CHOOSING A SCOPE MOUNTING SYSTEM

For best accuracy, a telescope sight must be mounted solidly to the rifle in such a way that it stays secure, shot after shot. It doesn't make sense to spend a lot of money for a scope, and then secure it with a cheap mount. Precision-machined mounts that are designed for a particular scope and rifle cost more than some of the imported varieties, but the extra cost will pay off handsomely in dependability and increased accuracy.

A one-piece mount, such as the Redfield JR system, is the most dependable scope-mounting system available. Of course, this type of mount cannot be adapted to all rifles, but it is the recommended mount when it can be used. The rotary dovetail feature cams the ring into a mating dovetail in the base for a good, solid fit. This type of mount also allows you to remove the scope (not the base), and later replace it without losing the zero.

The split rings that hold the scope to the mount should be precision-bored to the exact diameter of the telescope sight, which is usually 1 inch in diameter (7/8 inch on some scopes designed for .22 rim-fire rifles). If the rings are precision-bored so that a full radius contact with the scope is maintained, an even pressure will be provided around the tube, thereby eliminating the problem of squeezing the tube out of round, which sometimes happens with strap-type mounting rings.

The Redfield JR base features an outside windage adjustment that is capable of overcoming scope mounting problems caused by drilling the mounting holes out of alignment with the bore, or where barrels have been threaded into the action at an angle.

## MOUNTING THE SCOPE TO THE RIFLE

Most scope mounting holes that are drilled and tapped at the factory are fitted with plug screws. These should be removed carefully with the proper size screwdriver so as not to mar the screw heads or the adjoining surfaces. Save these screws in case you want to put them back into the holes later.

Make sure these mounting holes in the receiver are clean and absolutely free from oil and grease. A solvent, such as AWA 1,1,1, will help cut the oil and provide a dry surface so that the attaching screws will not work loose under the repeated recoil of the rifle. Jet-





Fig. 7-1. Lock N'Seal is used to freeze the base screw to the receiver.

Aer Corp. also manufactures an excellent degreasing solution to use with their cold blueing kit. This solution will do a good job of cleaning the screw holes in the receiver and the base holes prior to inserting the screws for tightening.

For .22 caliber rim-fire and other light recoil rifles, you will probably be able to get a satisfactorily tight mount by tightening the mount screws as much as possible (without snapping off the screw head). However, for rifles with moderate to heavy recoil, use LocTite Super Lock N' Seal compound to freeze the base attaching screws to the receiver. Shellac or fingernail polish applied to the screw threads will do the same thing. However, if you intend to remove the base anytime in the near future, this practice is not recommended. Removing the screws once they have frozen to the receiver is near to impossible, although sometimes they can be loosened by saturating the screws with acetone and penetrating oil. The regular LocTight Lock N' Seal (not the super strength) can be used to help tighten screws, yet it is relatively easy to remove with normal tools. This latter compound is probably the best choice if you are going to use anything at all. It is also a good compound to use on loose action screws since it restores worn parts to their original tight fit. It flows into gaps and fills to .015 inch, then hardens into a solid



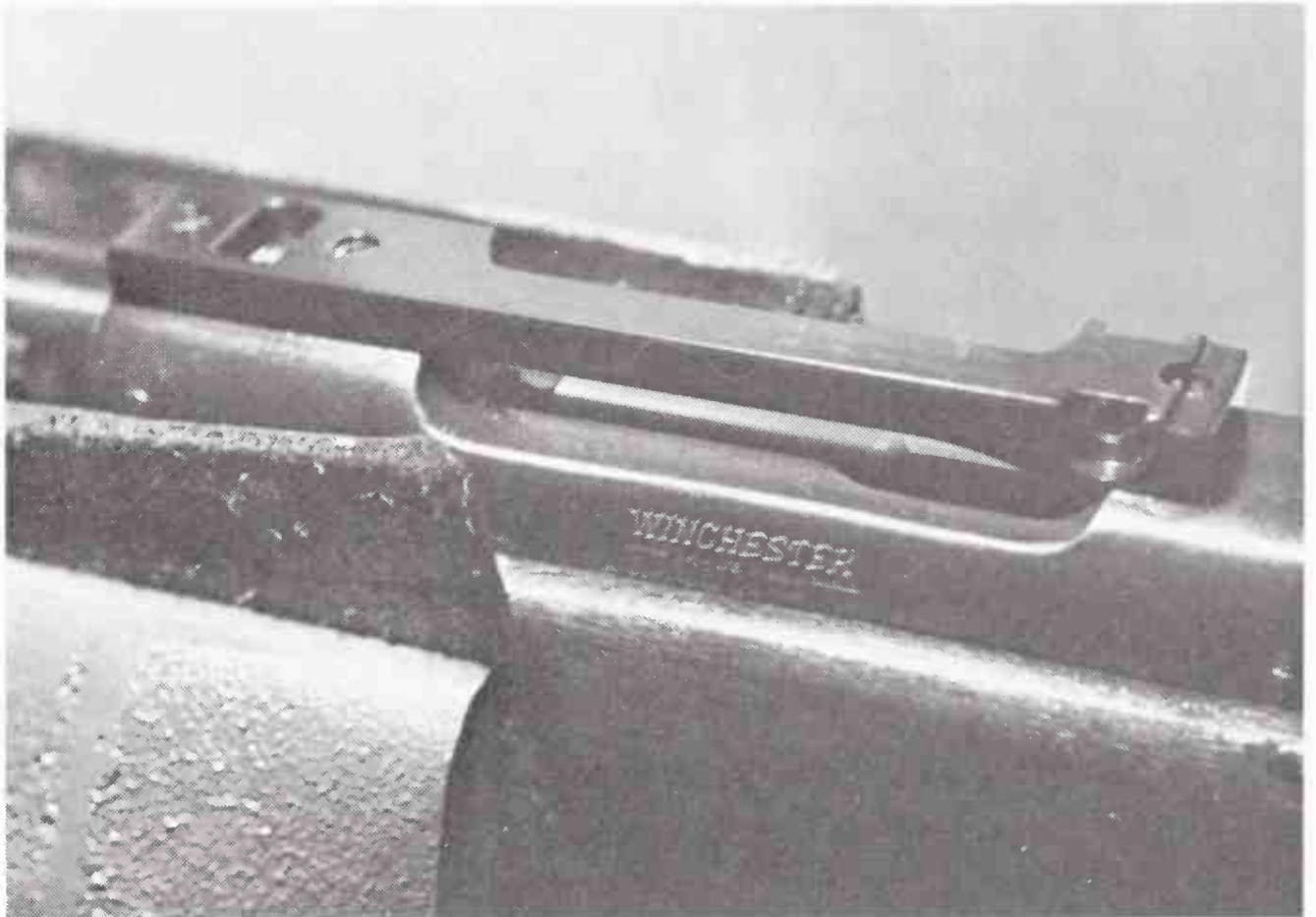


Fig. 7-2. Redfield JR sight base mounted on Winchester Model 70 receiver.

with 1,700 psi strength. Wipe any overflow from the action or mounts before it hardens.

Before applying any Lock N' Seal or similar product, install the scope mounts in the normal way, then check the operation of the rifle. If the base screws are a little too long, they will interfere with the function of the action. For example, if one of the mount screws in the forward receiver ring protrudes into the receiver, the locking lugs on a bolt-action rifle will not lock. Over the past several years, I have had several customers complain that their new rifle would not fire. In many cases, the trouble was traced to scope-mounting screws that were protruding too deeply into the action, blocking or hindering the movement of the action parts.

Base screws that are too long can be filed down. In many cases, it will take only a stroke or two of a mill file to correct the problem. Hold the screw in a pin vise, then file the end of the screw level trying to avoid damaging any of the threads that remain. Should the threads become damaged, merely run a die over the thread to recut it.

Next inspect the scope itself in relation to its position on the

action. Set the scope in the mounting rings, and tighten the rings just enough to hold it in position while you test the operation of the action. Does the action function properly? Will the bolt (in the case of bolt-action rifles) clear the scope? Many of the wide-view type scopes will not work on some bolt-action rifles since the bolt will not miss the wider viewing end of the scope. If this is the case, move the scope forward to miss the bolt completely, alter the bolt handle, or use a different scope. In any case, the time to test for proper operation is before locking the screws into place with Lock N' Seal.

When that all is working as it should, place a drop or two of Lock N' Seal into the screw holes, or on the screw threads, and tighten the mounts to the rifle action. Install the rings, and mount the scope according to manufacturer's directions.

## ADJUSTING EYE RELIEF

Before final tightening of the rings, hold the rifle at your shoulder in your normal off-hand shooting position and slide the scope forward or rearward in the rings until the full field of view can be seen in the eyepiece. You will notice an area of about one-half inch

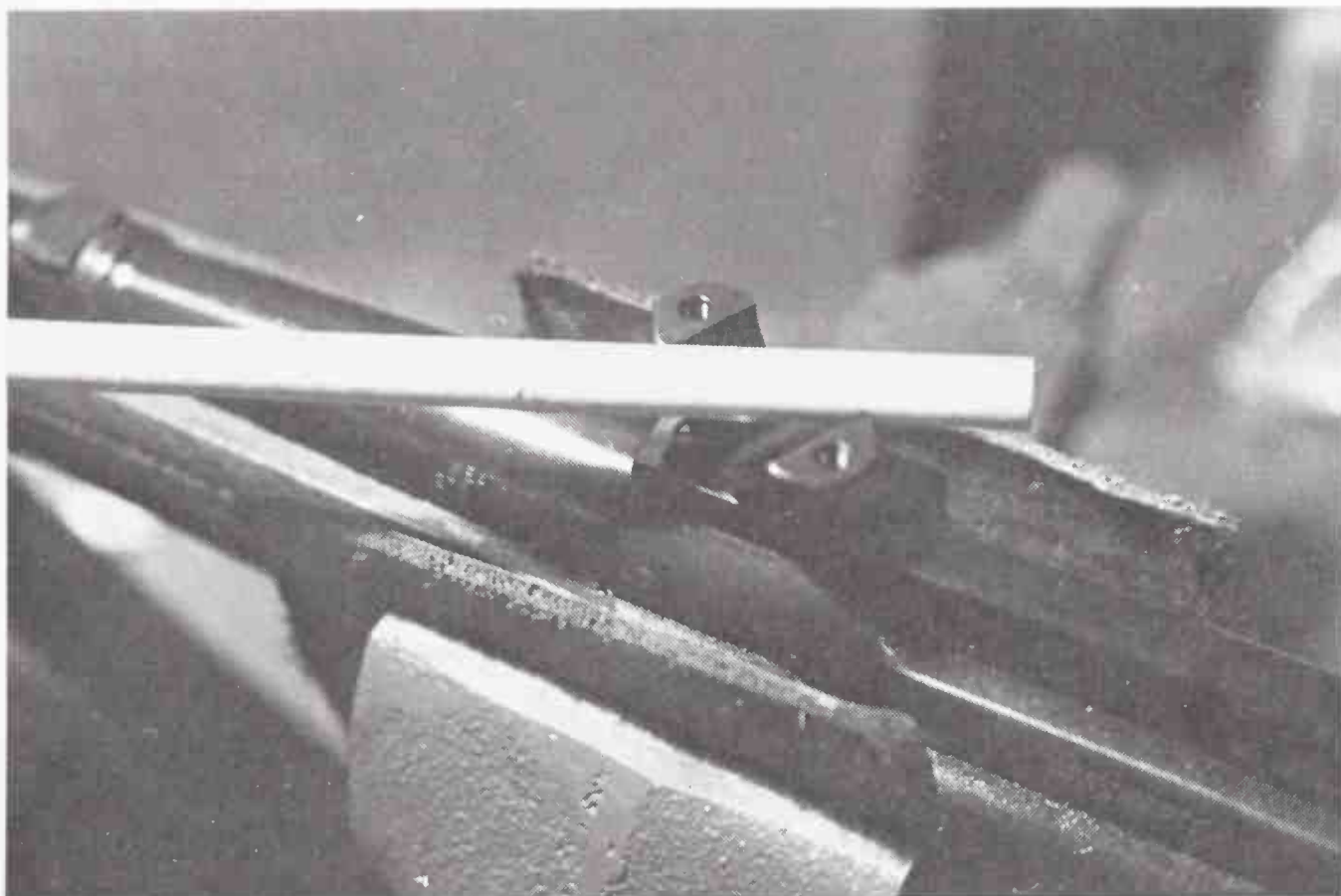


Fig. 7-3. A wooden dowel being used to twist the front mounting ring into position. Until the metal-to-metal contact between the ring and the base gets broken in, it is not a good idea to use the scope itself to twist these rings; you may damage the scope.

where the full field is visible. Move the scope to its most forward position for maximum eye relief. When the scope is properly positioned, rotate it until the horizontal cross hair is parallel with the ground plane. Tighten the rings.

## SIGHTING IN

You can save a lot of time, not to mention ammunition, by bore sighting your rifle before zeroing it with ammunition. Collimating is the most accurate system and is the one used by most gunsmiths. It can be done quickly at home or in the shop before leaving for the range. The collimator is clamped to a spud that is aligned with the axis of the bore. The collimator emits a pattern, usually a grid, that appears to be at infinity.

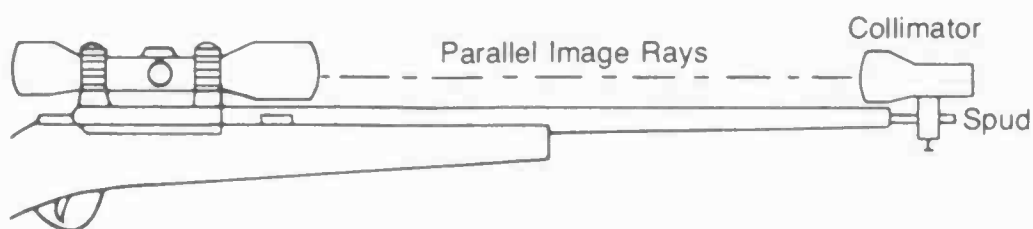


Fig. 7-4. Collimator in position for presighting the scope.

Place the collimator in position, then remove the two adjustment turret caps on the scope. The elevation knob is marked *UP* on most scopes with an arrow indicating the direction to move the point of impact up on the target. The windage knob is marked *R* (right) with an identical arrow.

The increments marked on the graduated scale around the knobs indicate the amount of point-of-impact movement in minutes

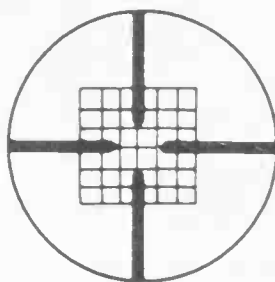


Fig. 7-5. When sighting through the scope, this is the image that can be seen when the collimator is in place.



of angle (MOA). One MOA equals  $1/60$  of a degree of arc. Since point-of-impact change is measured in angles, the amount of actual movement on the target increases as the distance to the target increases. For convenience, 1 MOA equals 1 inch at 100 yards. (It is actually 1.047 inch, but for this purpose, 1 inch will do.) It therefore equals 2 inches at 200 yards, and 3 inches at 300 yards.

Using the scope adjustments described, align the scope reticle intersection with the center of the grid. The scope is now parallel to the axis of the bore. This adjustment will enable you to place your first shot well within the edges of an 18-inch target. The scope is now ready for sighting in.

If you do not have access to a collimator, make preliminary sight adjustments by bore-sighting with most bolt-action rifles. Obviously, lever, pump, and semiautomatic actions cannot be used with this method since there is no way to sight down the bore from a shooting position.

Place the rifle on a steady rest such as sandbags or a Decker Shooting Vise. Remove the bolt and, looking down the bore from the receiver end, move the butt of the rifle around until the target—at least 25 yards away—is seen centered in the bore. Without moving the rifle, glance through the scope, making reticle adjustments with the knobs on the scope until the reticle is centered on the target. Look through the bore again to be sure the rifle has not moved off

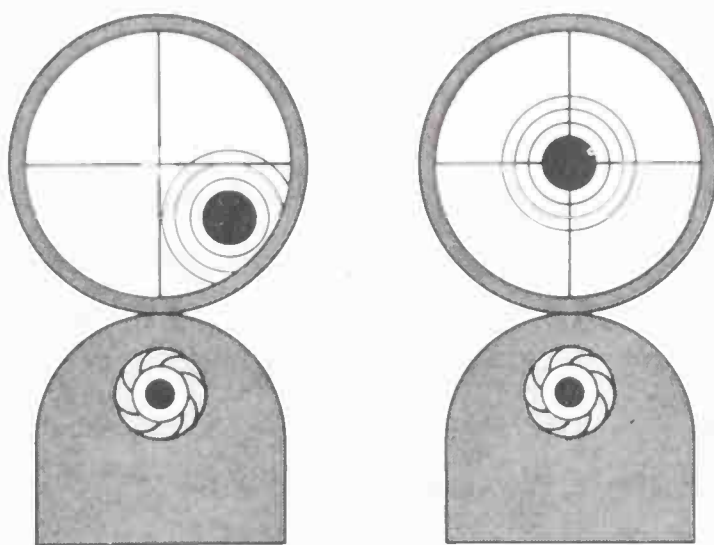


Fig. 7-6. When bore-sighting a rifle, first sight through the bore of the rifle and line up your target. Then, when you sight through the scope, the target will probably appear as in the left-hand picture. Adjust the scope until the target is centered in the cross-hairs as shown in the right-hand picture.

target. If you will be actually firing at a target 100-yards away, move the adjustments so the cross hairs appear about 1 inch or so below the center of the target. This will allow for bullet drop from muzzle to target because when you center the cross hairs on the target, the bore will be slightly higher.

The distance of the target for actual firing will depend on the distance at which you normally expect to be shooting. Many hunters zero their scope at 200 yards. When sighted in at this range, the mid-range trajectory for most popular hunting cartridges is usually not more than 2 inches high at 100 yards and they will still shoot effectively out to 225 yards or more. If you do not have access to a 200-yard range, consult a trajectory chart and have your bullet strike at the appropriate height above center at shorter ranges. For example, if you have access to a 100-yard shooting range but you want to sight .270 Winchester to strike center at 200 yards, first consult ballistic tables as supplied by the ammunition manufacturers. Remington ballistic charts indicate that a 130-grain bullet should strike 1.7 inches high at 100 yards to be zeroed at 200 yards. Therefore, in actual firing, adjust the scope until the bullet strikes 1.7 inches above the point of aim at 100 yards, and the rifle will be sighted in for 200 yards.

For best accuracy, zero your rifle yourself since no two people hold or fire a rifle in exactly the same way. Use a solid bench rest and tripod or sandbags for best results. Rest the forearm, not the barrel, on the bag and if possible, zero the rifle in a no-wind condition.

When shooting at 100 yards or more, the bullet crosses the line of sight twice; the first time about 25 yards from the muzzle, and then when the bullet strikes the target or gets to the range in which the rifle is sighted in. If you are unsure of the accuracy in presighting the rifle and want to avoid a wasted shot, set up a target about 25 yards from the muzzle. This will give you a better chance of hitting the target with the first shot. Once you have a shot on the target to go by, make adjustments until the bullet is printing in the center of the target. Remember, you will need to make four times the amount of correction at 25 yards as you will to move the point of impact the same amount at 100 yards.

To zero the rifle, fire three shots at the desired range. Using the center of the three-shot group as the hypothetical point of impact, make the proper adjustments until the group is printing where you want it.

## TOP-EJECTING RIFLES

Some rifles, like the Winchester Model 94, eject the fired cartridge out through the top of the action, making it necessary to mount the scope in an offset position in order to allow the cartridge to pass. One solution to this problem is to use one of the several mounts on the market designed specifically for the Winchester Model 94 rifle. Model 94s of recent manufacture require no drilling and tapping, and the mounts are installed similar to other types on which the receiver has been predrilled and tapped at the factory. However, you will have to cock your head slightly in order to view through the scope since it is offset from the line of bore (fig. 7-7). Many shooters do not like this, preferring either to omit a scope sight altogether or to buy another type of firearm.

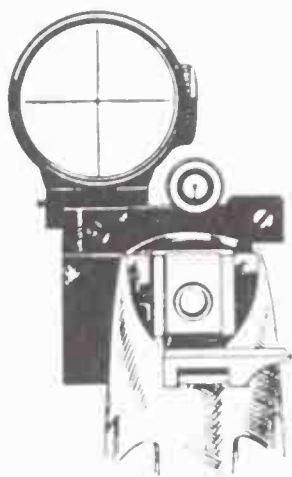


Fig. 7-7. To use a scope sight on some rifles, such as the Winchester Model 94, the scope must be offset to allow room for the cartridges to eject out of the top of the receiver.

A somewhat better solution is to use a Leupold M8-4X Extended E.R. Scope mounted forward of the receiver. The long eye relief of this scope permits the shooter to view through the scope from the extended range. Leupold also makes a unique mount especially for the Winchester Model 94 that requires only minimal drilling of the middle barrel band to accept one 6x48 base screw. Another screw fits into a threaded slot that fits the dovetail cut where the rear sight is secured. This arrangement is a little different and takes some getting used to, but after a few rounds on the range, the rifle and image come up naturally, and viewing becomes second nature. Unlike some mounts that require drilling of the barrel to accept the mount screws, this particular mount requires drilling only the barrel band. So, you can correct a mistake by purchasing another barrel band.



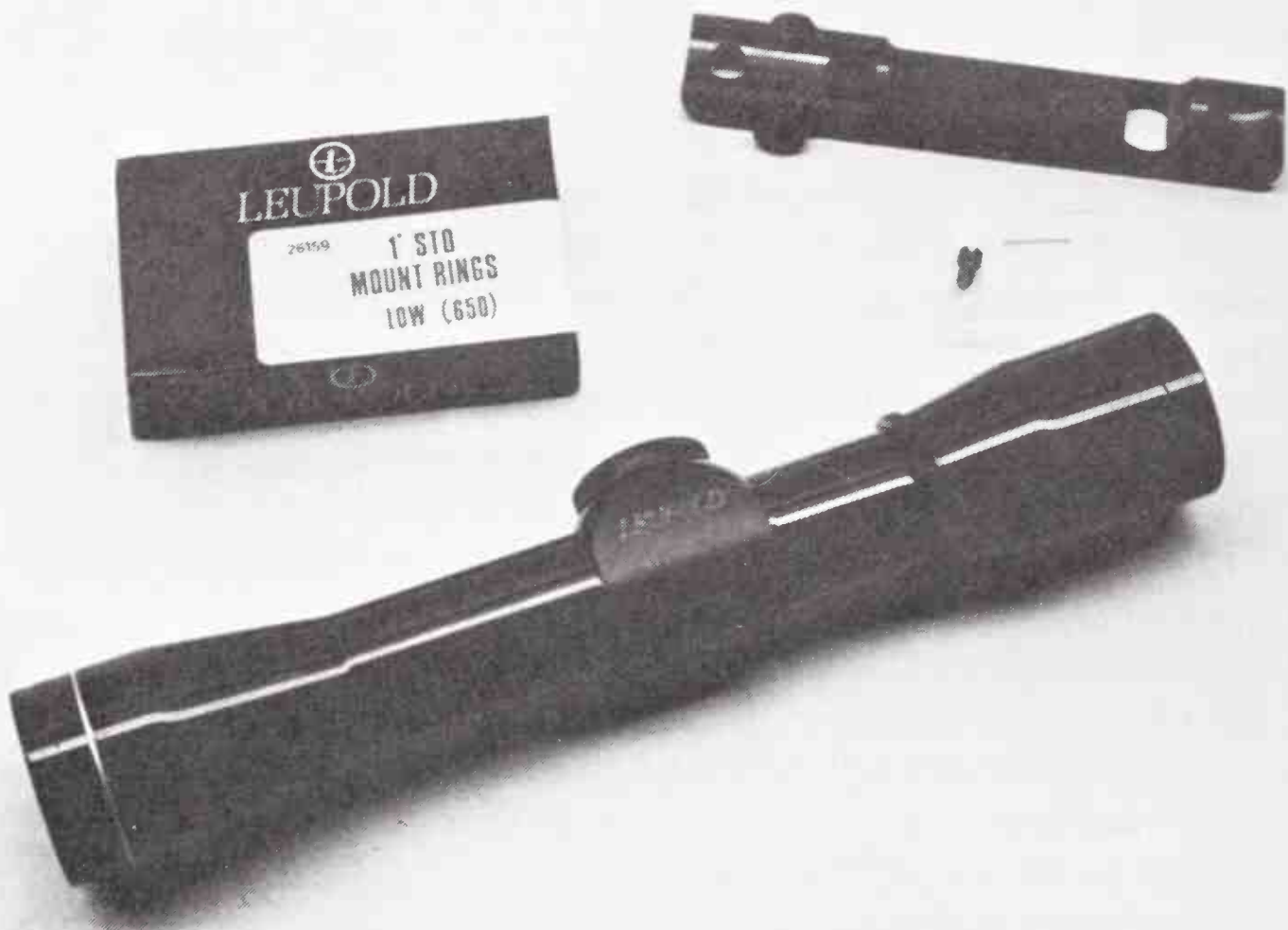


Fig. 7-8. Leupold M8-4X Extended E.R. Scope and Mount specially adapted to the Winchester Model 94 rifle enables the scope to be mounted in line with the bore.

To mount a Leupold M8-4X Extended E.R. Scope on a Winchester Model 94 rifle, secure the rifle in a padded vise so you will have both hands free to perform the operation. In thirty minutes or so, the rifle should be ready for zeroing in on the range.

Use a standard hand drill, a No. 31 wire gauge bit, and a No. 6-48 bottoming tap. Add a tube of Lock N' Seal and you have everything necessary to mount the base onto the rifle. You will need a hex wrench to tighten the scope ring screws when you are ready to mount the scope itself.

Once the rifle is secure in the vise, use a brass or nylon punch to remove the rear sight from the dovetail on the barrel. Drill the sight out from left to right as you would sight down the barrel. In fact, almost all dovetail devices on firearms are driven out from left to right, looking from the receiver to the muzzle.

The dovetail filler block that comes with the sight mount must be inserted in the rear sight dovetail very tightly. Most are a bit oversized for that purpose. If it is too tight, file it a little before inserting it into the dovetail. On the other hand, if the filler block



Fig. 7-9. Dove-tail slot in place, and barrel band drilled and tapped for Leupold scope base.

is too loose, tighten it somewhat, either by pinning in the shoulders of the dovetail or raising craters in the bottom of the dovetail by using a center punch. Do not try to make it work if the filler block is too loose. The sight will shoot loose after only two or three shots.

Once the filler block is in place, loosely set the mount on top of the barrel so that the front recess (in the bottom of the mount) fits directly over the barrel band. Insert the rear screw, and turn up a

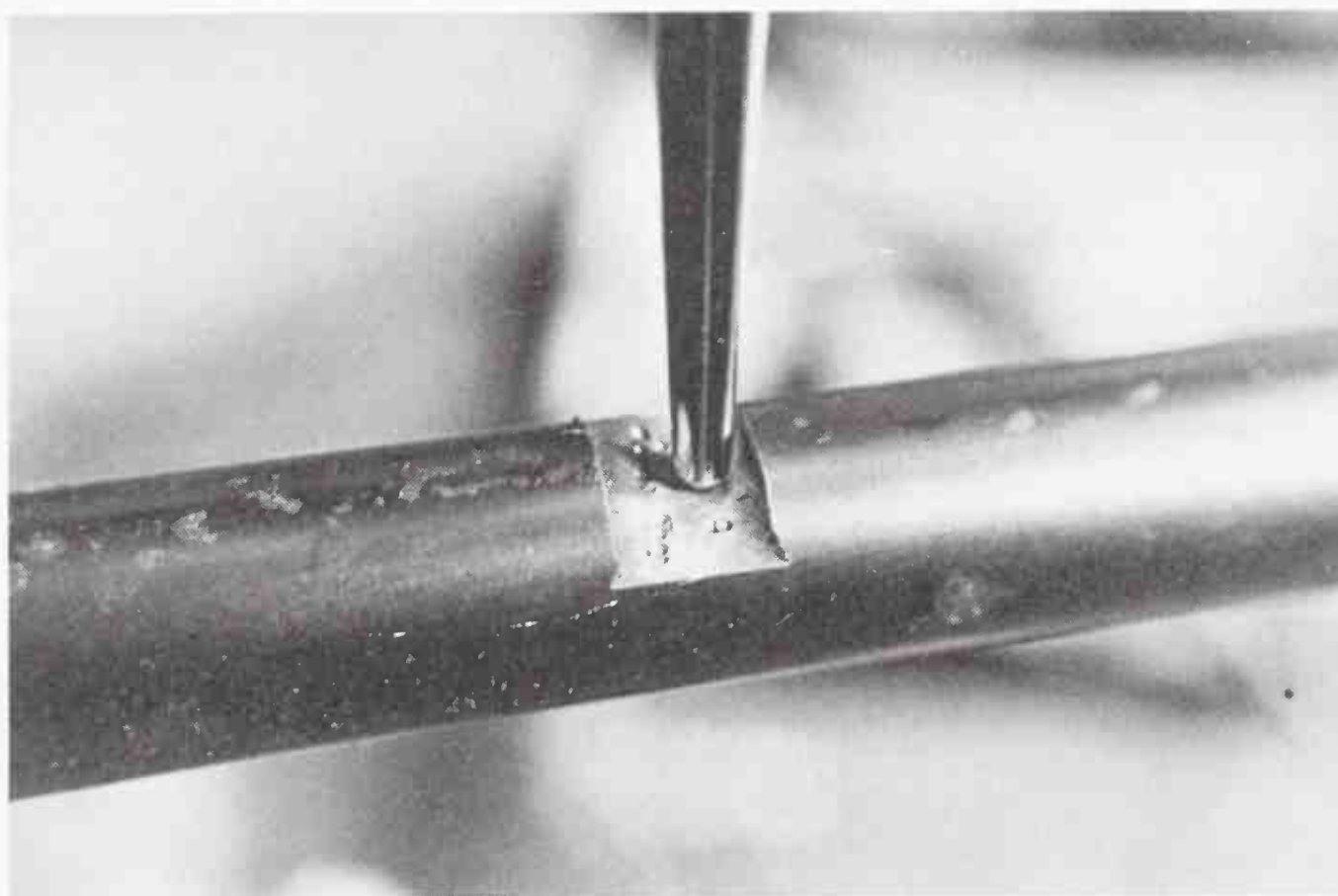


Fig. 7-10. A center punch may be used to raise craters in dove-tail slots to tighten sights and other items that are to fit into them.

few threads into the threaded hole in the dovetail filler block. Eye-ball the base—sighting down the barrel—to see that it is level, not tilted to one side or the other. If it is tilted, move the dovetail filler block until it is perfect. Now tighten the rear screw.

The front hole, the one over the barrel band, will now act as a guide for drilling a hole into the top of the barrel band. Use a hand drill, or if you have one, use a drill press, the job will be easier. The safest way to drill the hole is to use a No. 25 wire gauge drill bit which fits snugly into the existing screw hole on the mount. Make sure the bit is perfectly aligned with the hole so as not to remove any metal around the edges of the hole. Tap this bit lightly (once in the hole) to mark the center onto the top of the barrel bank. Remove the bit, and use a center punch to make the crater a little deeper. Now use a No. 31 bit to drill the hole into the barrel band. If you are careful, you can drill the hole without removing the barrel band from the rifle. But to play it safe, you can remove the band once the hole is started, and finish drilling and tapping it once it is off. If you choose to leave the barrel band on, you will need a bottoming tap; if you take it off, a conventional taper tap will be all that is needed.

Make sure the tap is perfectly aligned and start turning the tap until you feel it bite into the hole drilled with the No. 31 bit. Back it out about a quarter-turn, then take another bite with the tap, progressing a little further this time before backing it off again about a quarter-turn. Repeat these operations until you reach bottom. Be extremely careful as you approach the bottom of the hole as taps are very brittle and will snap off in an instant if too much pressure is applied. A sharp tap will cut threads easily, so if you feel that it is not cutting easily, you have gone far enough. If you ever break off a tap in a screw hole and have to get it out, you will certainly be more careful next time.

You can make the tapping operation go smoother by using a clean lubricant such as Brownell's DO-Drill, which is specially designed for drilling and tapping operations in all types of heat-treated steels.

Clean the threads that you have just cut, and try the 6-48 screw to make sure it fits. Use Lock N' Seal on the threads of both screws, and firmly seat the screws in their appropriate holes—firmly, but not tight enough to break off a screw head. Next, assemble the scope-



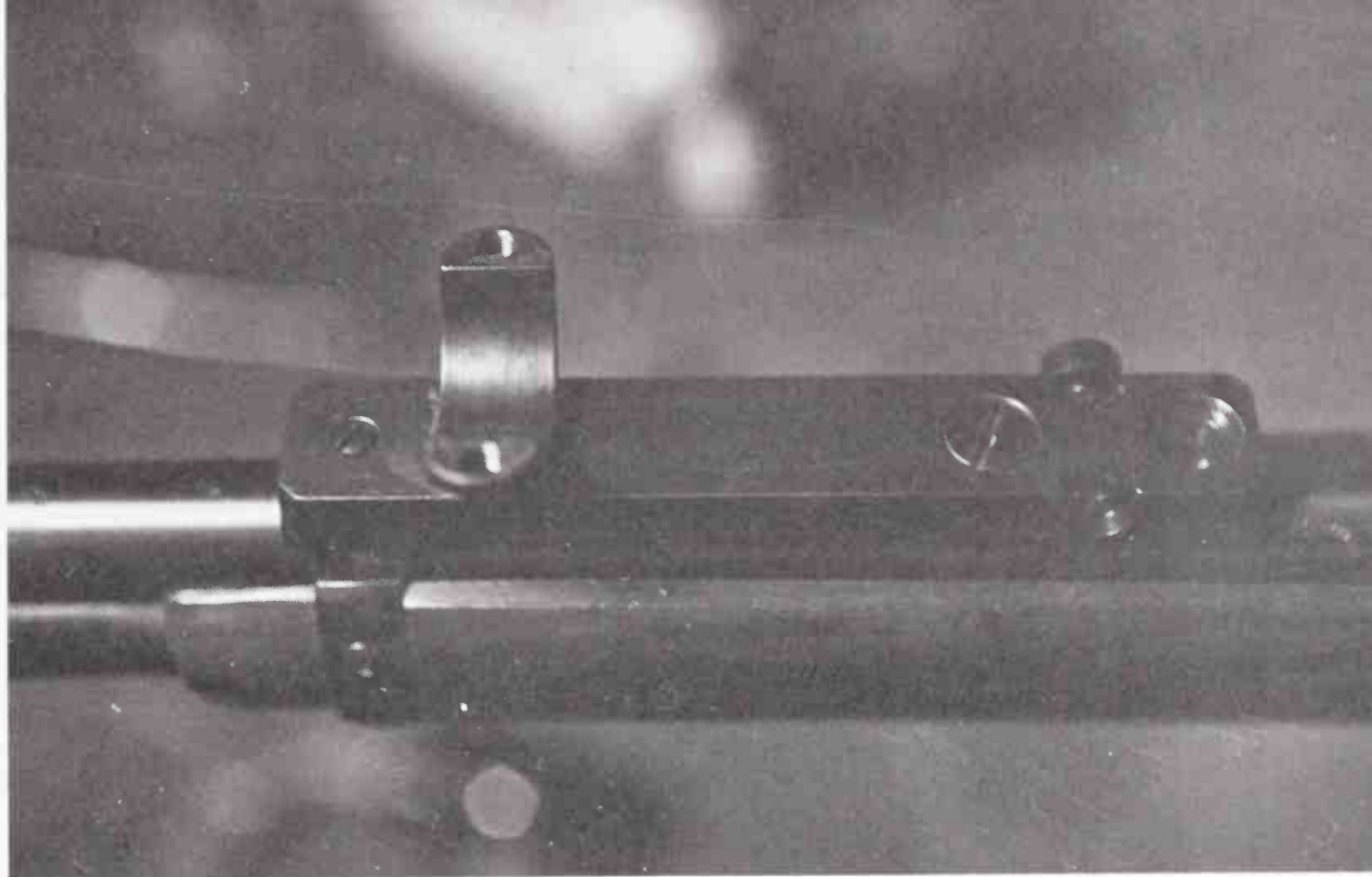


Fig. 7-11. Leupold Winchester 94 scope base in position.



Fig. 7-12. The Leupold Extended Scope makes an ideal scope arrangement for the Winchester Model 94.

mounting rings onto the base, following the recommended procedure. Then remove the top portion of the rings, set the scope onto the bottom of the rings, and replace the tops. Do not tighten the rings yet—just have them in position.

With the scope as far forward as possible, hold the rifle as you would in a normal shooting position. Slowly move the scope rearward just until you can see the full field of view. Being careful not to change the eye-relief positioning, rotate the scope until the elevation adjustment is at top center. Then check the vertical cross hair of the reticle to see if it is lined up with the vertical axis of the rifle. When you are satisfied that everything is squared up, take up the ring screws evenly and firmly. Again, it is important to take the time to make sure screws are as tight as you can get them without stripping the threads or damaging the screw heads.

Metallic sights of the *peep* type are often desirable on rifles for close-up shots in heavy cover. Manufacturers of these sights make them for practically every rifle. In fact, most rifles manufactured in the past thirty years have holes that were factory drilled and tapped for receiver sights. The mounting procedures are similar to those given for telescope sights.

## SIGHT-DRILLING JIGS

Since sight jigs are expensive, it is not recommended that the beginning gunsmith, who might only drill and tap one or two rifles for scope mounts, purchase one. Instead, have the work done by a professional. However, if you plan to get a Federal Firearms License and do scope mounting for others, you will definitely want to purchase some sort of sight jig to make the work easier and quicker, not to mention assure better accuracy in performing the operation. Since most of your work will be on military bolt-action rifles—Mausers and Springfields—a B-Square Professional Drill Jig is recommended. It is a little expensive, but it will enable you to perfectly align mount hole-spacing for Weaver, Redfield, and Buehler bases on all Springfields, Enfields, Japs, Mausers, and Remington Model 30s. This jig eliminates the need for  $\nabla$  blocks, clamps, and measurements. Once the jig is installed, it automatically locates holes in reference to recoil shoulder and aligns and spaces vertically on the centerline of the receiver. It is accurate, easy, and foolproof;

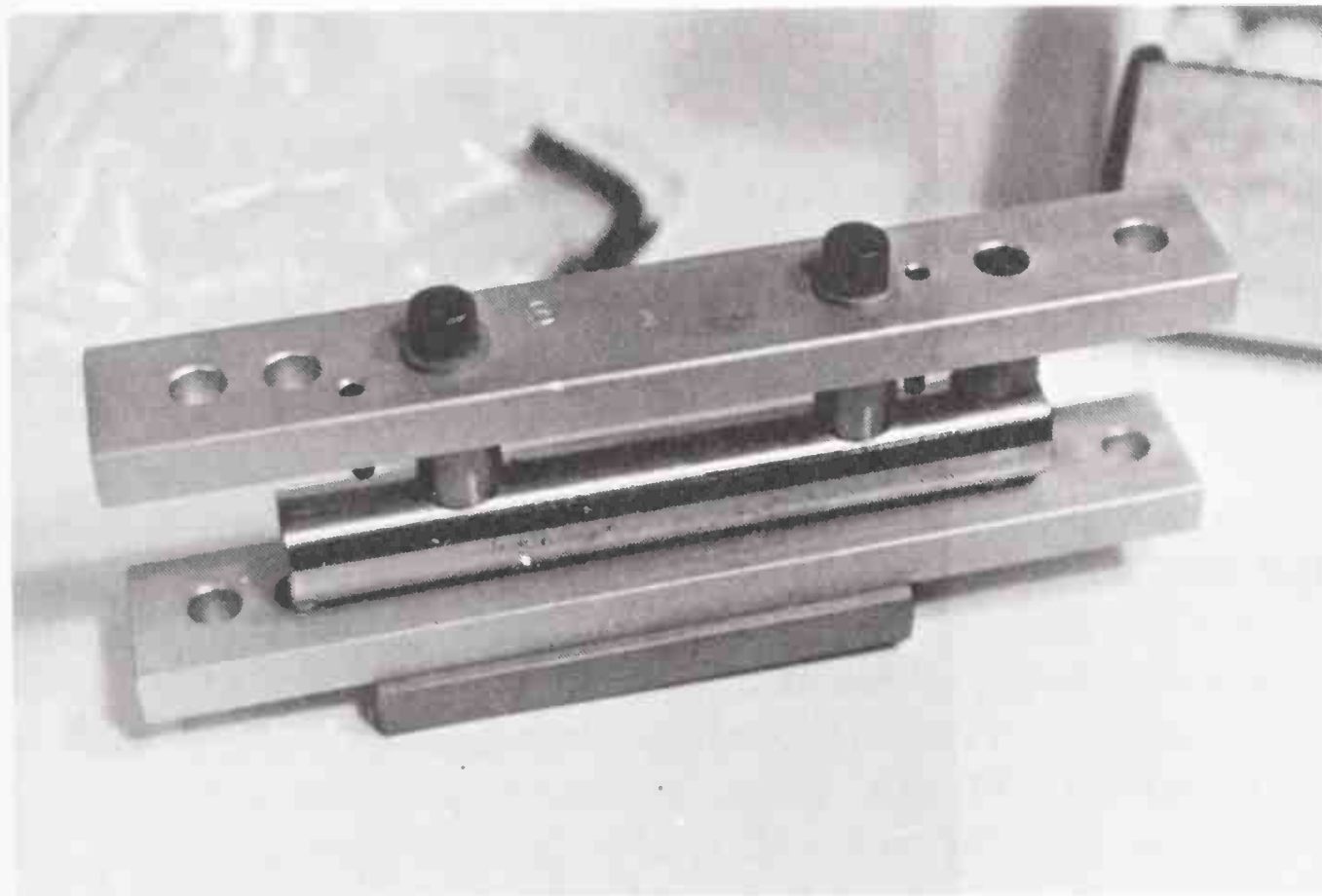


Fig. 7-13. B-Square Professional Scope Drilling Jig will pay for itself time and time again if many scopes are to be mounted on bolt-action rifles.

holes are drilled at one time without moving the jig. Bushings are available for both 6-48 and 8-40 screws—the two most common sizes for scope mounting.

Other jigs include receiver sight jigs, barrel sight jigs, Winchester Model 94 scope jigs, and universal sight mounting fixtures. All are relatively expensive for the amateur, but they will pay for themselves time and again if much drilling is done.

Since the B-Square Professional Scope Mounting Drill Jig will perhaps be the most useful to the average gunsmith, a brief description of its use follows.

Certain preliminary steps are required when using the jig, and these vary depending upon the type of rifle. For example, on all Japanese military rifles, the base block must be installed with the narrowest hole edge distance forward, and the trigger assembly must be removed prior to drilling. On Mauser receivers, you must be sure there is clearance between the  $\nabla$  bushing and the left-hand side of the receiver. On some Mausers, it is possible that interference with the  $\nabla$  bushing will deflect the jig. In these cases, file or grind the  $\nabla$  bushing side until it clears, but be careful not to disturb the arbor contact area of the  $\nabla$ .



To install the jig, remove the stock and bolt from the receiver and insert the bore align into the rifle receiver. Place both  $\nabla$  bushings with their  $\nabla$ s over the arbor holes before placing the jig bar recesses (counterbores) on the  $\nabla$  bushings. Place the base block against the bottom flat of the receiver and insert the Allen screws. Before tightening the screws, however, slide the whole assembly forward until the jig bar stop pin contacts the rear of the front receiver ring. This locates the holes so that the scope mount recoil shoulder will bear against the ring. Place the drill bushing in the hole you want to drill. Clamp the whole unit in a drill press vise or just hold the barrel and keep the base block flat on the drill-press table while drilling. A large base plate can be made to attach to the base block's existing threaded holes.

The rear hole spacing in both bars will provide .504 inch spacing for both front and rear Weaver blocks. On some rifles the forward Weaver block hole spacing is .860 inch center to center. Use the same spacing as for front Redfield holes.

To install Weaver blocks on the rear bridge of the Springfield A-3 rifle use the Redfield bar marked S. This will locate the single hole required through the rifle dovetail.

On Mauser-type rifles, the Weaver block must be filed or ground on its forward end to fit the rear bridge and clear the bolt handle. The manufacturer also recommends that the rear hole in the front ring Weaver blocks be located using the Redfield spacing to enable Redfield, Leupold, or similar mounts to be installed later by drilling additional rear holes only.

When drilling the holes, check over your work before actually drilling to make certain that everything is lined up correctly. Be careful on all holes that the drill does not deflect and drill other than the correct location. It is also important when using Redfield mounts that the recoil shoulders contact the gun to prevent shearing the mounting screws, especially when firing heavy loads.

# **Trigger Repairs and Alterations**

AS EVERYONE KNOWS, the trigger on a firearm, when pulled, releases the firing pin to ignite the cartridge. But did you know that this part was originally called the "tricker," because when pulled it "did the trick"?

For best accuracy, triggers are not pulled. Rather, ever-increasing pressure is applied until the sear is disengaged, allowing the firing pin to fall against the cartridge primer, which in turn fires the gun. Furthermore, effective trigger squeeze requires proper follow-through, avoidance of the natural inclination to jerk or flinch at the moment the sear is released, so that disturbance of the gun (and consequently the aim) by abnormal finger movement is avoided. Therefore, trigger squeeze is very important for obtaining the best accuracy. Just as important is the trigger pull, the distance and pressure required to move the trigger enough to release the sear.

In general, trigger pull for hunting rifles should consist of a



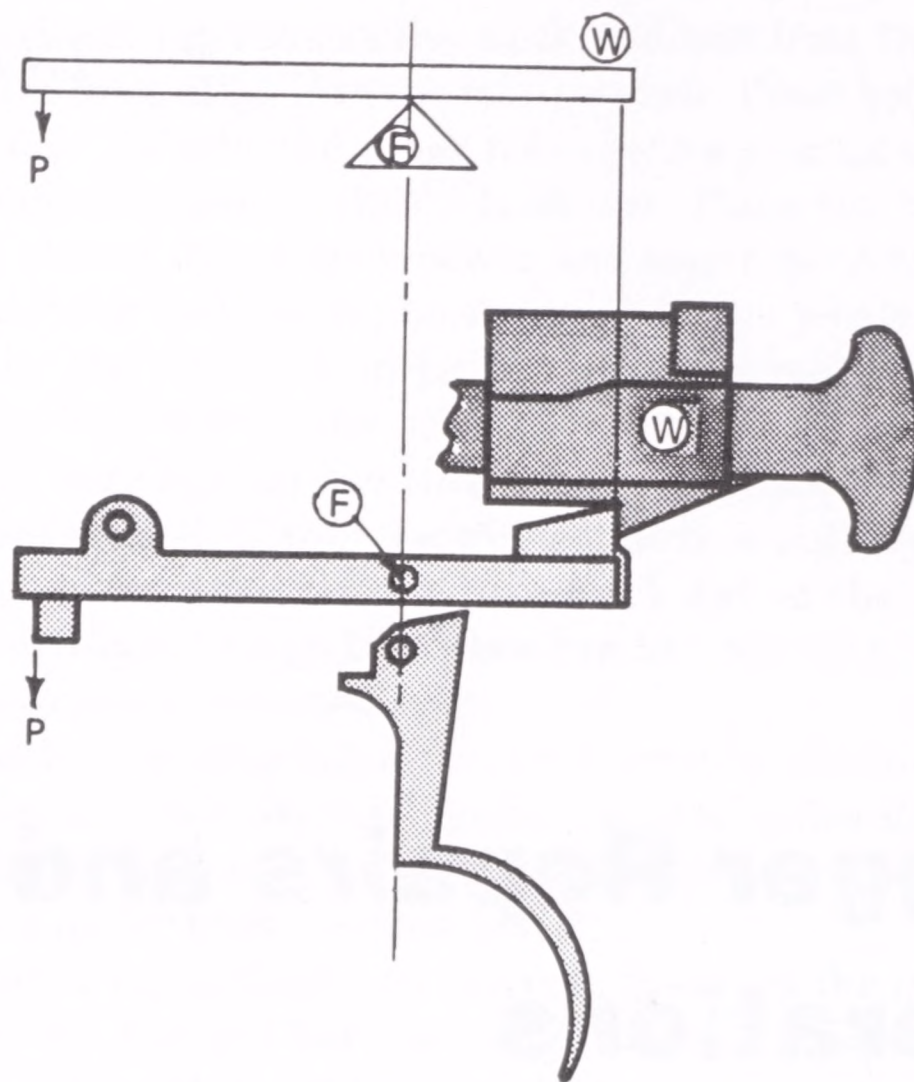


Fig. 8-1. Operating principles of a trigger mechanism.

short, 3- to 3 1/2-pound pull. Any trigger pull that is much more than 3 1/2 pounds will hinder the control of the shots, and any pull less than 3 pounds is normally considered too light for a hunting rifle.

## TRIGGER MECHANISMS

Trigger mechanisms usually consist of three essential parts, not including springs or pins: hammer (cocking piece, plunger, or striker), sear, and trigger. In all cases, the hammer is held in a cocked position by the sear engaging in a notch. The sear may be a separate part, or it may be the upper end of the trigger itself. The quality of any trigger pull is governed by the bearing surface smoothness of these three interacting components.

In mechanisms in which the sear functions as an integral part



of the trigger, the trigger is pivoted by means of a pin or screw between the upper end, which forms the sear, and the lower end, to which the pressure is applied. This type of trigger operates on the primary lever principle with the trigger becoming a lever, the sear forming the weight, and the pin or screw forms acting as the pivot point or fulcrum. The finger supplies the power at the lower end.

When a separate sear is interposed between the trigger and hammer or striker, a dual leverage system is formed, and the trigger is usually a secondary-type lever. In this case, the weight is located between the pivot point and the power and is transmitted to the trigger through the sear. The sear may be either a primary- or secondary-type lever, according to the design of the mechanism.

Various classes of lever principles are shown in figure 8-2. In all examples, the closer the fulcrum is to the weight, the less pressure is required for movement. When applying these principles to trigger mechanisms, the closer the pivot point of the trigger is to the cocking piece, the less trigger pull is required. However, the lighter the

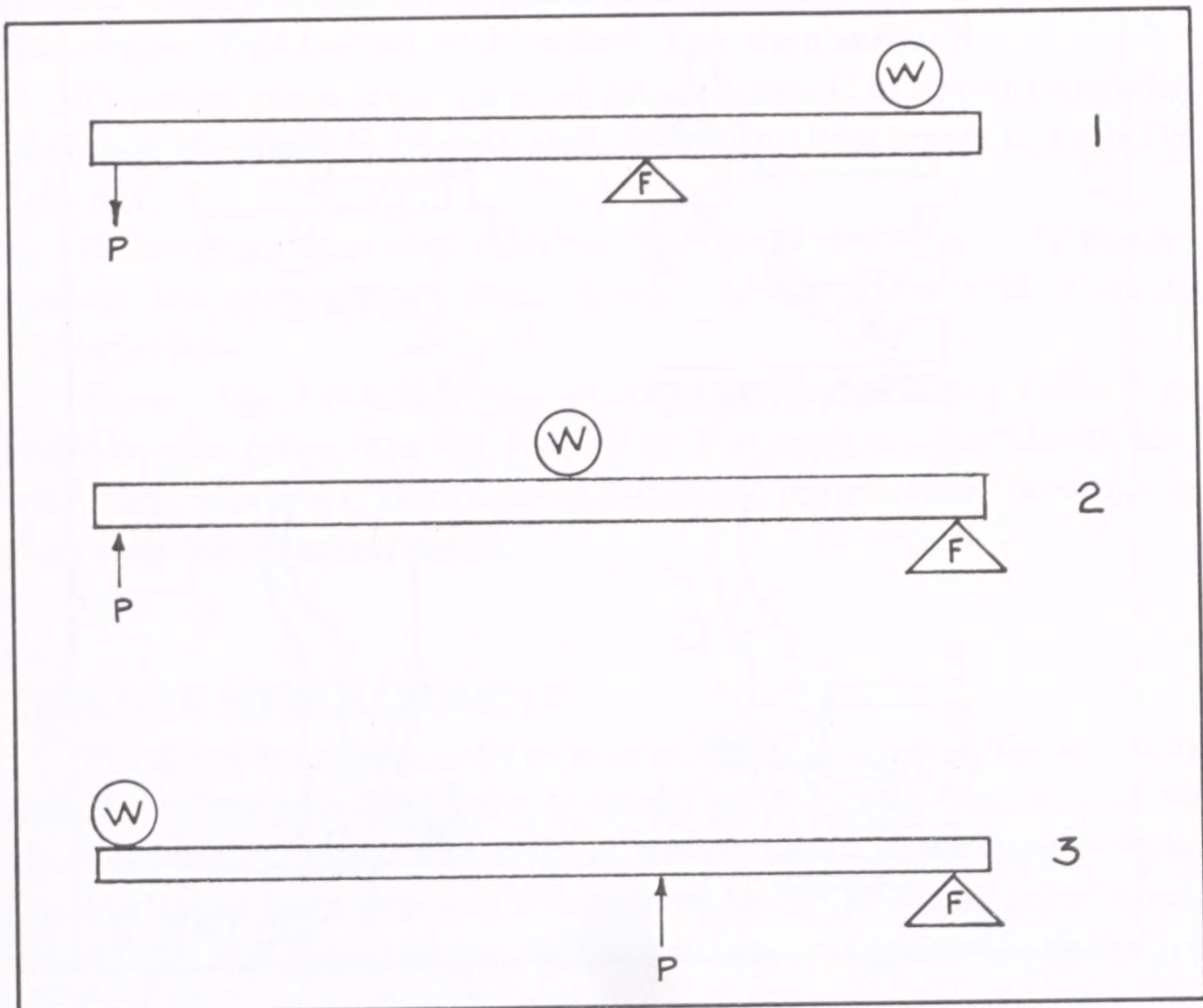


Fig. 8-2. Various classes of lever principles.

trigger pull (in a two-stage trigger mechanism), the longer the trigger travel and the greater the creep. *Creep* is the first stage of the trigger's travel to the rear usually requiring a pull weight of one to three pounds. Then to release the sear for firing, a separate three to six pounds of pull weight is required.

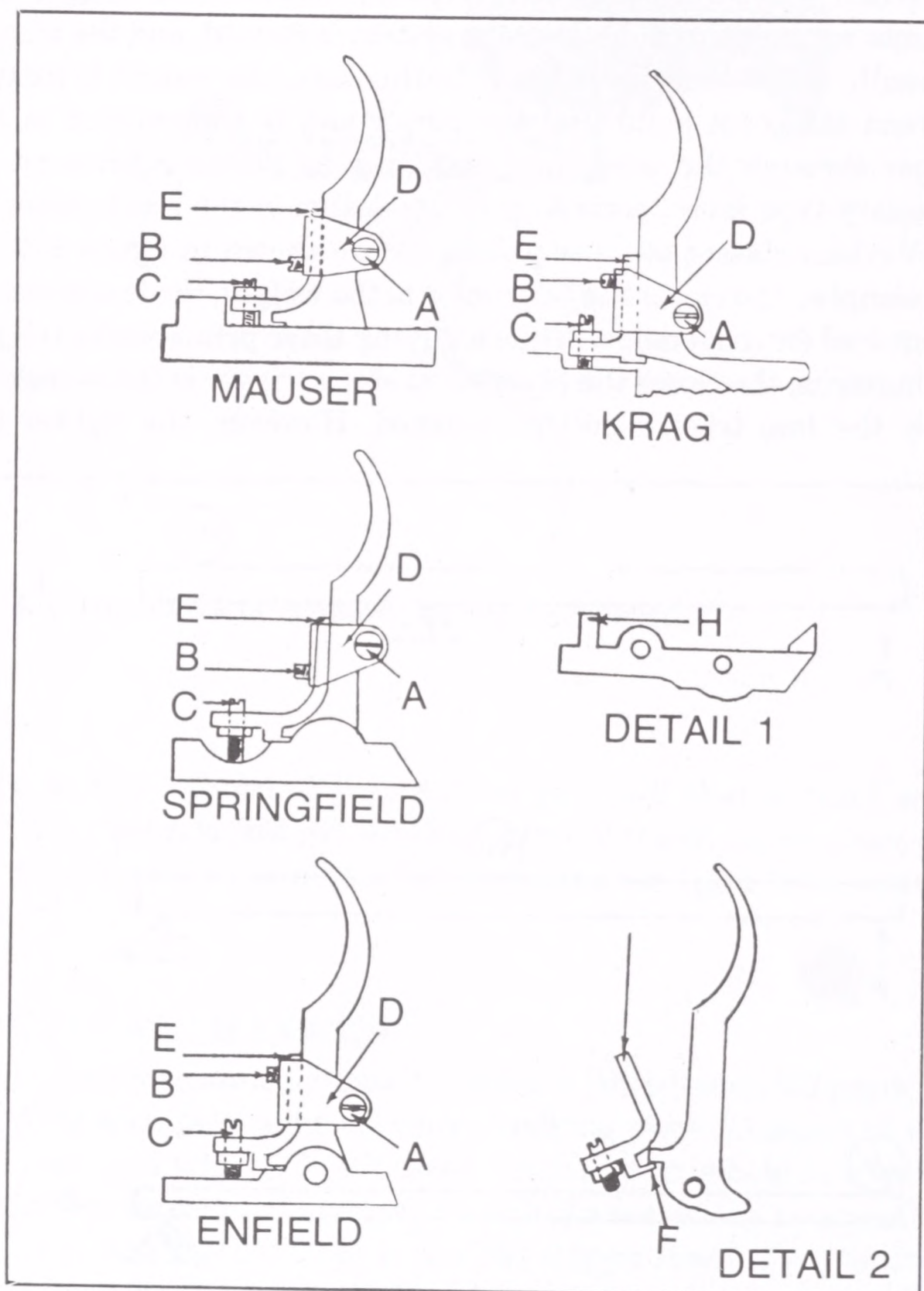


Fig. 8-3. Viggo Miller's simple device to improve trigger pulls on military weapons.



## IMPROVING MILITARY TRIGGERS

Military triggers are usually of the two-stage type and are notorious for creep and hard trigger pull, but they can be improved upon in a number of ways. Probably the easiest way is to purchase one of Viggo Miller's military trigger attachments, which are designed to eliminate creep and enable the mechanism to be adjusted as far as depth of the trigger sear engagement is concerned.

To attach one of these devices to the trigger mechanism of a .30-40 Krag rifle, remove the stock of the rifle to get complete access to the action and trigger mechanism. Hook the adjusting screw bracket *E* (fig. 8-3) into the slot at the base of the trigger. Back screw *B* out from the clamp piece until it is flush with the inside of the clamp (*D*). Next, remove screw *A* from the clamp so that the clamp can be slipped over bracket *E*. Afterward, replace screw *A*. The trigger of the .30-40 Krag is tapered and if the clamp is at the upper part of the taper, it will be easier to insert screw *A*. Then push the clamp down towards the lower end on the taper, being sure lip *C* (detail, fig. 8-3) on the bracket remains tight against the base of the trigger. Tighten screw *B* first, and then screw *A*.

To adjust the trigger turn adjusting screw *C* in or out as needed to obtain the desired trigger pull; lock adjusting screw *C* with the lock nut.

If there is not enough clearance around the trigger to accommodate the attachment, remove some of the wood with a stock-maker's chisel.

Since trigger mechanisms on other types of military rifles vary slightly, the procedure for installing the trigger attachment also will vary. However, complete installation instructions accompany each individual attachment.

## TRIGGER REPLACEMENT

For ultimate speed, safety, and accuracy in a converted military weapon, many gunsmiths prefer to replace the issue trigger with an all new, easily adjustable trigger mechanism. These mechanisms are available from gunsmith suppliers. In most cases, only minor alterations are required to replace the issue trigger with the more modern one.

Dayton-Traister Company, for example, manufactures an all-



steel trigger mechanism with case-hardened operating parts, expertly honed to deliver crisp, uniform trigger pulls every time. The tempered, treated, and blued springs resist corrosion and fatigue, and the grooved finger area helps provide a nonslip finger grip. Trigger mechanisms are commonly available for most military weapons and sporting arms.

Custom trigger mechanisms normally are adjustable from two to six pounds to give a converted military rifle a faster lock time and to increase the accuracy with a uniform, crisp trigger pull.

For target or bench-rest shooters (and some hunting where fine accuracy is required), a double-set trigger mechanism is often installed. In double-set triggers, as the name implies, the front trigger serves a dual purpose affording the shooter two advantages:

1. To fire the gun at a normal trigger-pull weight as set by the installer at the time of installation.
2. To let off at a true hair-trigger setting when cocked by the rear trigger.

The front or hair trigger on most mechanisms is fully adjustable for let-off pull weight from ounces to several pounds. Such trigger mechanism is especially suitable for unusually long shots when even the faintest pull, when firing the gun, could cause a complete miss. Such triggers have long been popular with serious varmint shooters and bench-rest shooters. Even many muzzle-loaders employ the set-trigger mechanism.

Most double-set triggers are easily installed, but slight alterations usually are required to the trigger guard slot and the stock wood where the existing trigger protrudes.

## **HONING TRIGGER PULLS**

In most cases, every trigger mechanism—from inexpensive .22s to more sophisticated triggers—can be lightened or smoothed by honing all bearing surfaces to reduce friction. For military trigger assemblies (and most other types also), the two most important bearing surfaces include the trigger sear and the cocking piece sear.

To polish or hone trigger mechanisms, you will need a sturdy vise to hold the parts being polished, a set of hard Arkansas stones, and a magnifying glass to inspect your work. The set of Arkansas stones should be of different shapes and sizes to enable you to match the stone to the shape of the part being polished. The Gunsmith

Hard Arkansas File Set, available from Brownells, Inc., contains all the true-ground sharp angles, straight edges, and flats needed for precision trigger and sear work, accurizing, and close-fitting whenever fine stoning is needed.

The main objective in honing trigger sears is to make certain that the corners are square. Here is where the magnifying glass comes in handy; make sure to check your work every few strokes.

The first step in polishing a trigger sear is to disassemble the mechanism so that the sear is readily accessible. Then mount the part in a sturdy vise, using adequate padding and positioning it so the sear can be polished with a hard stone when held at a right angle. Note that you are polishing; you are not trying to remove any appreciable amount of metal so as to cut below the glass-hard surface. Rather, you want to smooth the existing surface to reduce friction between bearing surfaces. Be careful not to change the angle of the sear when polishing or round the edges. The best approach is to "cut" in a forward motion only, like when using a mill file. Do not seesaw back and forth as you are sure to round the edges of the sear.

Unless the sear is in unusually rough condition, a dozen forward strokes with the Arkansas stone should be enough. Check your work every couple of strokes with the magnifying glass to insure that the edges are kept square.

If you mess up or if the edges are already rounded, correct as shown in figures 8-4, 8-5, and 8-6. You may find that a hard Arkansas stone will take forever to complete the job. In this case, begin with a soft stone which will cut faster, and finish up with a hard stone for final polishing.

Next, polish other bearing surface on the cocking piece. Again, secure the piece in a vise, and using a hard Arkansas stone, polish the sear. Be careful to follow the original angle and avoid rounding the edges. A dozen forward strokes should do it.

Now test your work. Reassemble the trigger mechanism and action, cock it, and test the action. If you have a trigger-pull gauge, measure the weight of pull before and after the polishing. You should see a big improvement in the smoothness. If the smoothness is still not quite to your liking, repeat the polishing. Test the smoothness often and be extremely careful not to remove too much metal. Remember, you can take off more metal, but you cannot put it back.



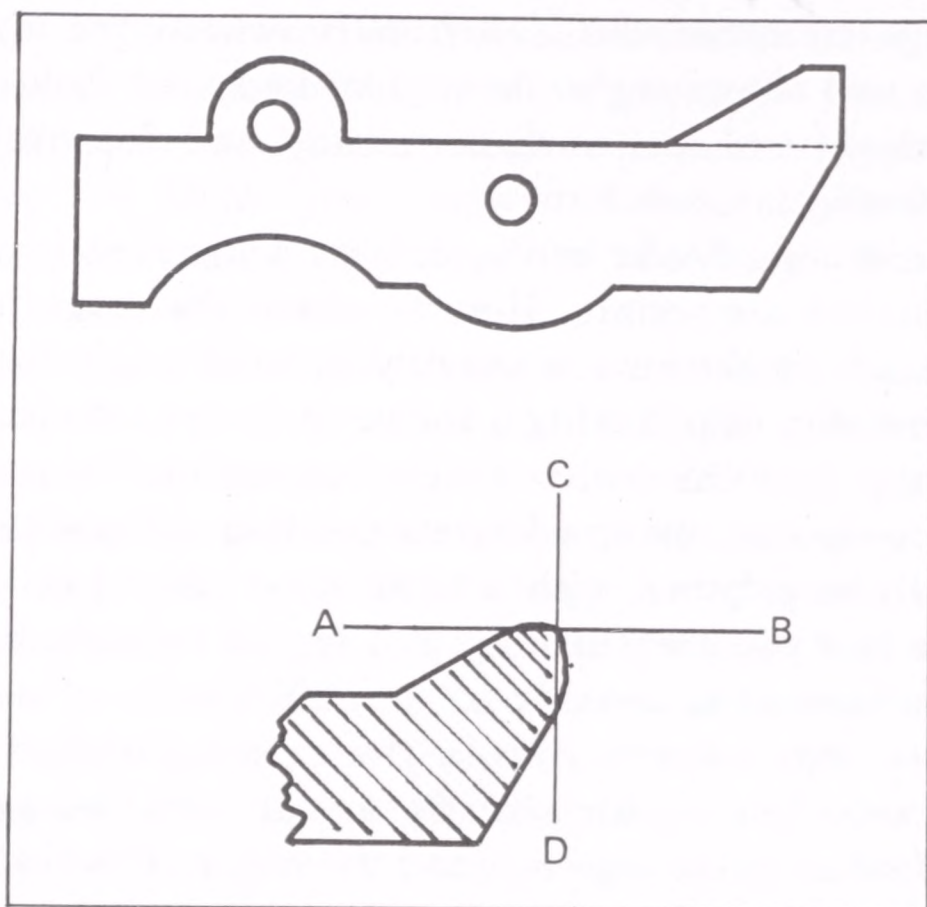


Fig. 8-4. Square-up rounded sears as indicated on lines AB and CD.

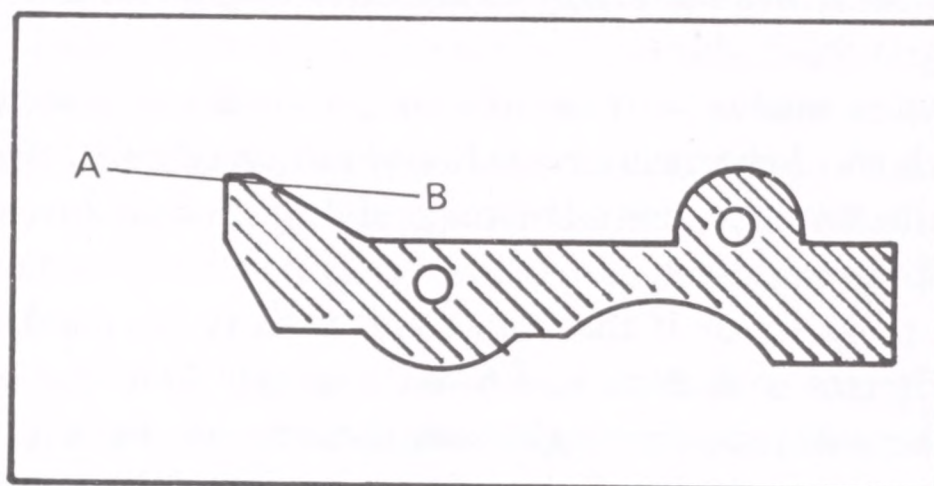


Fig. 8-5. Lightly stone top of trigger sear along line AB to lighten trigger pull, by changing angle.

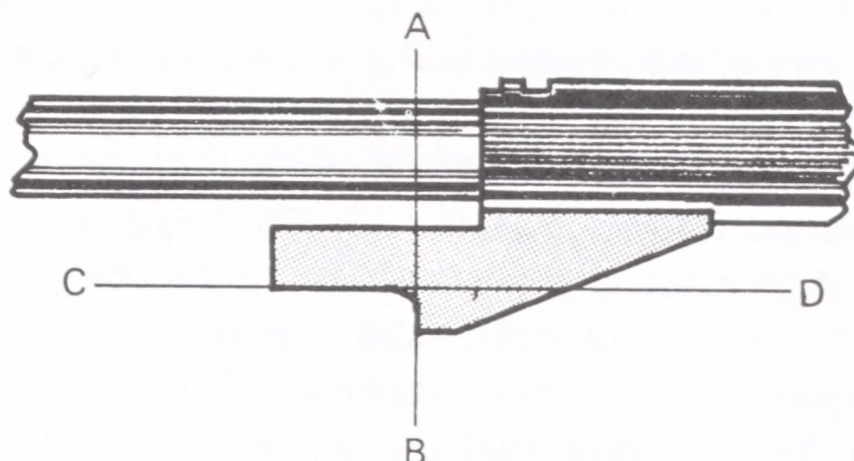


Fig. 8-6. If you should remove too much bearing surface on the sear, you can increase the trigger pull weight by deepening the notch in the cocking piece following the line AB and CD.



In the majority of cases, this honing process will improve the trigger pull significantly. The best honing job on a military trigger mechanism, however, is not going to produce a trigger pull like a two-stage set trigger.

If the trigger pull is still unpleasantly heavy, and the accuracy is not good, try changing the angle of the sear ever so slightly. When performing this operation, you must be even more careful than when polishing, as one wrong cut will create new or worse problems, often-times ruining the trigger mechanism completely. Position the sear in a vise, and using a soft Arkansas stone, draw it over the sear to change the angle. Although the angle is changed, the corners and edges of the sear must still be square, not rounded. When the angle has been changed, polish the new surface with a hard stone.

The first few times you attempt to change the angle of a sear, take only three forward cuts with the soft Arkansas stone, then polish the new surface with a half dozen or so passes with the hard stone. Next test the gun for pull. These steps may have to be repeated several times at first, but after completing several jobs, it will only take two or three tries to get it right. If too much metal is taken off, or the angle of the sear is made too sharp, the gun might fire on closing of the bolt which will require considerable work to correct.

After the trigger pull is the way you want it, test the gun for safe operation by opening and closing the bolt several times to make sure the cocking piece holds. Then lightly jolt the butt stock against the floor of the cocked, but *unloaded* rifle. If the cocking piece does not fall, the rifle—and your work—should be safe in respect to the trigger mechanism.

## CORRECTING CREEP

Removing creep from double-stage triggers usually requires the skill and knowledge of a professional if it is to be done correctly. However, there is no reason why the beginner cannot perform such an operation.

As mentioned previously, most trigger mechanisms on the older military rifles utilize a two-stage trigger mechanism which incorporates two fulcrums (humps) at the top of the trigger (fig. 8-7). The forward hump is responsible for the first-stage creep as when the trigger is pulled, the hump pivots against the underside of the re-

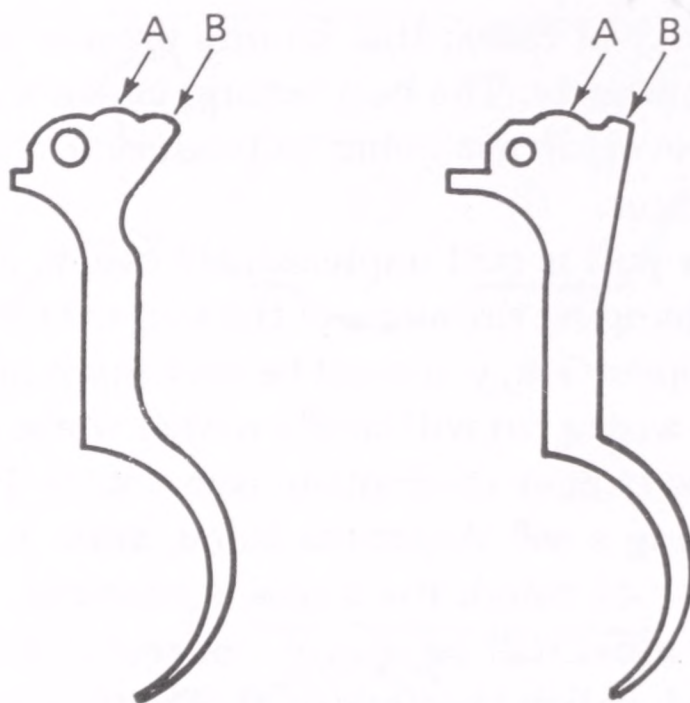


Fig. 8-7. Two humps (A and B) are responsible for two-stage let-off on military trigger mechanisms.

ceiver, creating a drag or creep. Its main purpose is to slow down the cocking piece let-off and inform the shooter that the discharge is imminent.

Creep can be eliminated by grinding this forward hump off. In doing so, the trigger sear will rise slightly higher against the cocking piece sear and provide a little more bearing surface. This will usually



Fig. 8-8. To eliminate creep, grind off hump A, and then slightly round off hump B.

correct the problem of a rifle accidentally firing when the bolt is closed, when the problem is caused by too much play between the cocking piece sear and the trigger sear or by too much metal being removed when trying to smooth up the trigger pull. But if the rifle was functioning correctly prior to removing the forward hump, you will now have increased the bearing surface which will of course increase the trigger pull weight. To correct this problem, use a soft Arkansas stone and slightly round the rear hump (fig. 8-8). Again, this operation should be done gradually with many trials during the process. If too much metal is removed here, the rifle will fire on closing of the bolt.

You should now have a smooth, light trigger pull that is equal in all respects to the trigger mechanisms on fine sporting rifles with the exception of those with long trigger pulls. Correct this by installing one of Virgo Miller's trigger attachments.

## **TRIGGER SHOES**

To improve the trigger pull, and consequently the accuracy, of any trigger mechanism, install a trigger shoe. Wide, serrated trigger shoes are available for nearly all rifles, handguns, and shotguns. Their function is to evenly spread the trigger release pressure over the ball of the trigger finger. With the pressure spread evenly, the trigger pull will seem lighter and give the shooter that delicate feel that is so necessary for controlled let-off. Trigger shoes are very popular among competitive rifle, pistol, and shotgun shooters and also anyone wanting to make a favorite gun perform better.

When installing a trigger shoe, however, be aware that the added weight of the trigger shoe may contribute to the accidental firing of a gun if it is dropped or if the butt is struck against a hard object, like the floor. Furthermore, the seemingly less pull may cause the shooter to accidentally fire a round before he or she is ready.





# **Stock Repairs and Alterations**

Minor stock repairs and alterations are good starting points for the amateur gunsmith for several reasons. First of all, the tools required for stock work are much less expensive than those used to alter metal parts; work on wood goes much faster than on metal; and mistakes made on a stock can often be repaired by filling or splicing another piece into the wood, while mistakes made on metal are permanent. But do not be too confident—do not start on the most expensive gunstock. Rather, practice the various techniques on scrap pieces of wood first, then on an inexpensive gunstock that can easily be replaced should it be ruined. After several such jobs, you should have gained enough skill and confidence to tackle more difficult projects on better gunstocks.

## **WOODWORKING TOOLS**

Only a small number of tools is required to begin stock repairs and

alterations. Most of them are available from Frank Mittermeier, Inc., and include the following:

1. Smooth-cut cabinet rasp for smoothing and shaping the stock
2. Chisel and gouges to cut away the extra wood required in working with a semi-inletted gun stock
3. Bottoming file for flat bedding of the action
4. Barrel-inletting rasp to shape the barrel channel to the exact dimensions of the barrel
5. Three hand checkering tools for checkering a gunstock or recutting an existing pattern during the refinishing process
6. Checking layout guide and instructions

Add some abrasive paper, steel wool, and a set of X-Acto knives and you are in business. With these tools, you will be prepared to do a considerable amount of stock work—either building new ones from semi-inletted blanks or refinishing stocks already fitted to firearms.

## REFINISHING STOCKS

After several seasons of use, a hunting arm will eventually need a face-lift. Some of the finish will come off and nicks and scratches will be present.

Begin by removing the stock from the barrel and receiver, and then remove all attachments, such as butt plate, sling swivels, and

Fig. 9-1. Worn butt stock and forearm for Winchester Model 94 rifle. Note that newspapers have been spread out over the work area to prevent fallout from the finish stripper from getting on objects around the area.







Fig. 9-2. Almost immediately after the stripper has been applied, the old finish on the gunstock will begin to bubble and loosen.

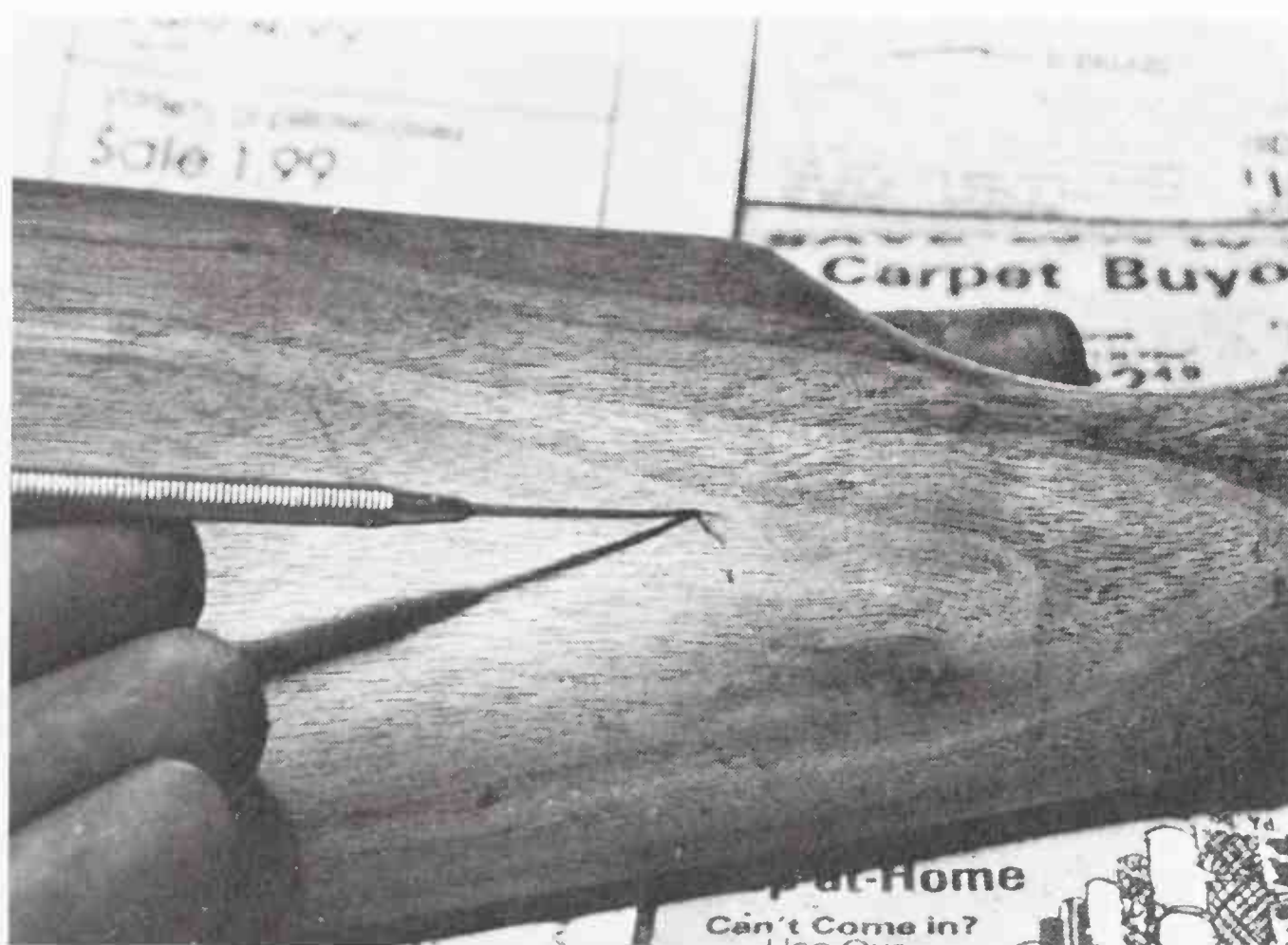


Fig. 9-3. A dent as deep as this one cannot be satisfactorily sanded out; it must be either filled in or raised with steam.

barrels bands, from the stock itself. Spread out old newspapers to protect your bench and the surrounding areas from the gun-finishing chemicals. Then spray the gunstock with a finish stripper, such as G96, being sure to cover all areas. The finish will begin to bubble in a few minutes, but let it stand for about five minutes, then wipe the stock with steel wool. Two applications of the finish stripper usually suffice, but three or four applications may be necessary on stubborn finishes. Continue wiping the stock with steel wool until all of the finish is removed and the stock is clean. Use a stiff toothbrush to scrub checkering patterns thoroughly.

At this point, examine the stock for nicks and scratches. Most of these can be removed with abrasive paper, but sometimes you will find a deep gouge like the one shown in fig. 9-3. If it is only dented and no wood is missing, the dent can be raised by applying steam to the area. Dampen a relatively thick cloth—like a wash cloth—and place it over the dented area. Press a soldering gun (fig. 9-4) against the damp rag. The heat will turn the water to steam, which will shoot into the dented area and cause the wood fibers to swell and rise to the surface of the wood. But do not expect instant



Fig. 9-4. Damp cloth and soldering gun used to raise dent in butt stock.





Fig. 9-5. After only one application, the dent has been raised considerably. However, it took about a dozen applications to raise this dent flush with the surface.

results. Although deep dents may require as many as twenty heat applications before the dents are completely raised, minor dents may require only a couple of applications. Use this method on all dented areas of the stock before continuing.

The stock should now be sanded with abrasive cloth. The object is to take off the least amount of wood possible. If the stock is fairly rough, start out with 80-grit sandpaper, progressively using smaller grits until you are down to about 400-grit and the stock is as smooth as glass. If the stock is in fairly good condition, start out with a finer grit of 180 or even 220. Sand with the grain of the wood to prevent scratching the wood with the abrasive cloth. Remember, take off only the amount of wood necessary to remove all nicks and scratches.

When the stock is glass smooth and no blemishes are present, apply the new finish. A look at any catalog of gunsmithing supplies will reveal several different types of gun finishes. Reading a description of each will help somewhat in deciding which finish you want.



If you have plenty of time (and the quality of the stock warrants it), use Dem-Bart Sealer-Filler and Dem-Bart Stock Finish. It is easy to apply, but requires a waiting period between coats which often makes it a week to ten days before the job is finished. However, it is an excellent finish which seals and hardens the wood, giving a desirable, low sheen, London-type finish.

First apply the Sealer-Filler to the stock with a lint-free cloth and allow it to dry for about fifteen minutes. Then sand the stock down to bare wood and apply another coat of filler. Let it dry, and again sand down to bare wood. Usually two coats will do, but I like to use three for good measure.

The stock finish can be applied with the fingers. Apply a generous amount on the wood, use fine sandpaper and sand the area while it is still wet (rubbing with the grain). Then wipe off all the excess oil and let it stand for about two days. Apply a second coat using the same method as the first time, and again let it stand for a day or two. Additional coats can then be applied until the desired finish is achieved as long as you wait at least twelve hours between coats. These later coats are rubbed in with the palm of the hand until the wood becomes hot from friction. Wipe off any excess and let it dry. Additional coats of finish can be applied later to refinish a stock that has been scratched from field use.

A faster method is to use G96 Stock Refinishing Chemicals, which can be purchased individually or in a complete stock refinishing kit. Remove the old finish as before and thoroughly wipe away all sanding dust. The stock must be clean and dry for proper refinishing.

The walnut stain that comes with the kit can be used to highlight the natural grain of the wood, and it penetrates and dries rapidly. However, if your stock is of a shade that suits you, omit this step. To use this stain, apply it to raw wood with a dauber (ball of cotton) or brush. Allow it to remain on the wood for about three minutes, then wipe dry. Reapply until the desired color tone is achieved. Allow it to dry for twelve hours, then sand lightly with a medium grade sandpaper.

If the wood has open grain (and most stocks on modern firearms do), apply the sealer and filler that comes with the kit. Shake and mix it well before using. Brush or wipe the G96 Sealer and Filler on the stock. Allow from three to four hours for complete drying

before sanding with fine sandpaper. Apply a second coat, allow the finish to dry, and sand it again with a finer grade of paper. You are now ready to apply the stock finish.

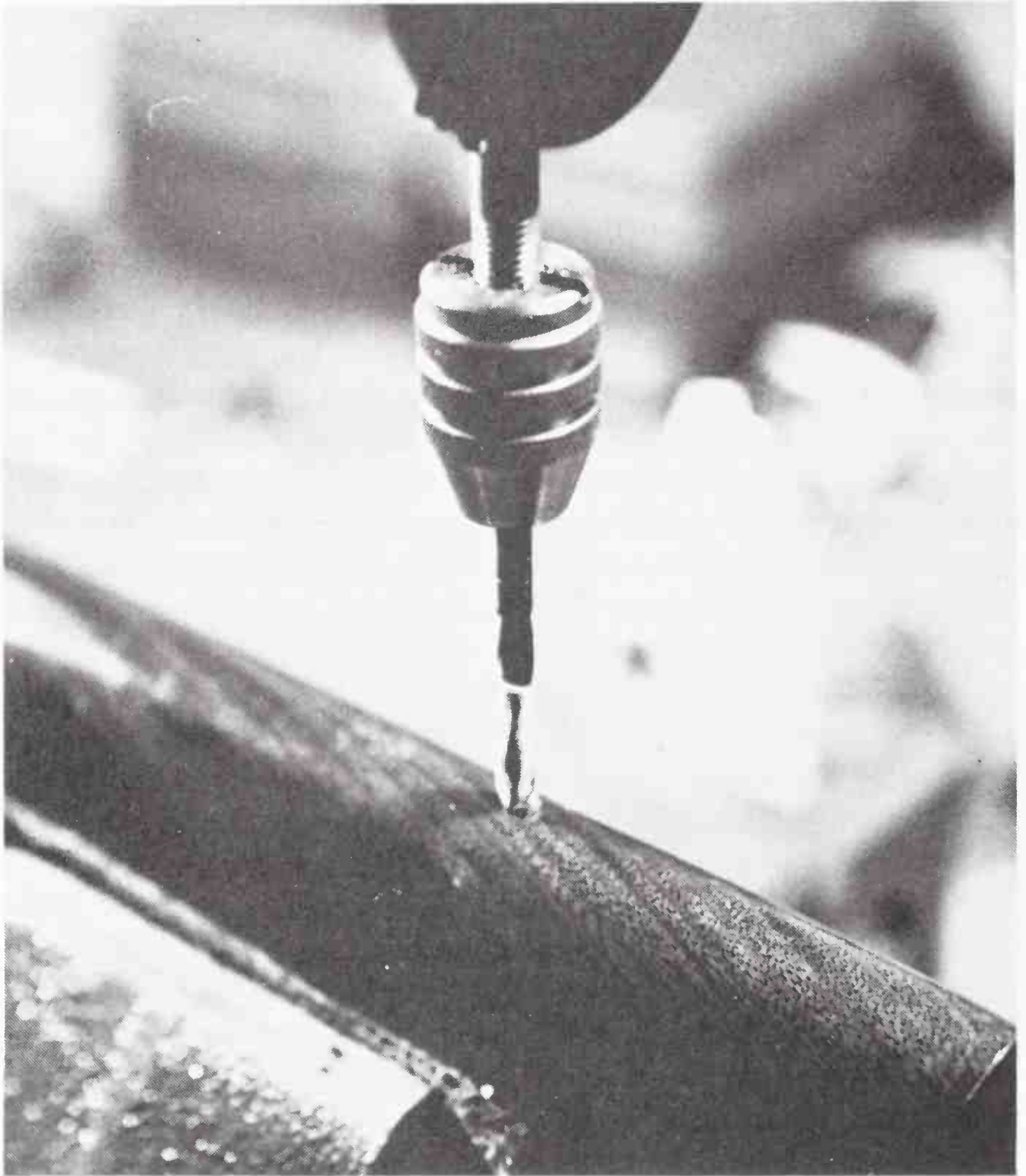
Before applying G96 Polyurethane Plastic Gun Stock Finish, shake the can well. Cover the floor, bench top, and surrounding areas to catch fallout from spray; newspapers work fine. Hold the spray can eight to twelve inches from the surface and spray the entire stock with a wide sweeping motion. Allow it to dry for two to three hours. When dry, rub it smooth with the finest grade sandpaper or steel wool. Wipe it dry with the tack cloth provided in the kit to remove all surface dust. Respray and allow it to dry for four to five hours before again rubbing it down with steel wool and wiping it dry with the tack cloth. Repeat this process until four or five coats have been applied. This will produce a high-luster finish. For a dull, oil-stained finish, rub down the last coat with rubbing compound or steel wool, followed by a wiping with the tack cloth.

For an even faster finish, following the previous instructions until the point of applying the finish. Then use G96 High Speed Linseed Oil for a professional-quality, permanent finish.

## **INSTALLING SLING SWIVELS**

Some rifles come from the factory with sling swivel studs already affixed to the stock, requiring only the purchase of quick-detachable swivels and slings for a complete installation. However, more rifles do not have the holes drilled. This makes a very good project for the home gunsmith. A hand or breast drill is all that is needed in the way of tools. If you anticipate much work of this sort, purchase a set of swivel-mounting step drills to make the drilling easier, quicker, and more precise. A special blade cuts cleanly without drawing down into the wood, and the unique step shoulder countersinks to the correct depth in one operation. But the job can be done with conventional drill bits.

Select a metal drill bit slightly smaller than the stud screw. Use a piece of masking tape to mark the depth of the screw, and after leveling and marking the cut with a center punch, use the hand drill to drill the hole in the stock to the proper depth. The hole should be drilled from 2 to 3 inches from the butt. Clean the hole out and screw in the rear stud screw using a drift pin punch or



**Fig. 9-6.** The pilot hole for sling swivel stud screws can be drilled with a hand or breast drill. Make sure the stock is firmly secured and leveled in a padded vise. Measure and mark the location of the stud and then drill the hole to the proper depth. Be careful to keep the drill perpendicular to the work area.

similar device for leverage. Do not forget to countersink the stud about 1/16 inch into the stock using a drill bit that is the same size as the diameter of the stud.

The hole for the front sling stud is a bit more complicated on one-piece stocks. Drill the hole completely through the forearm—about 2 inches back from the forearm tip. Countersink the outside



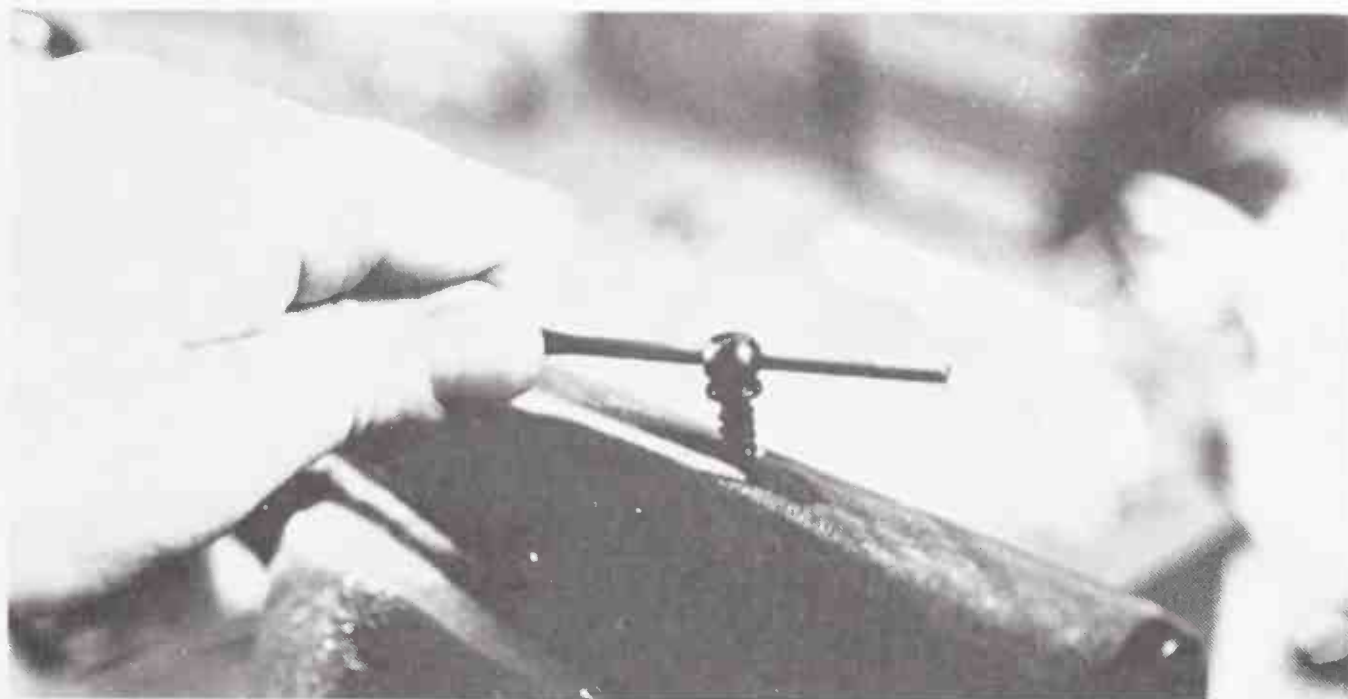


Fig. 9-7. A drift pin punch is used to screw the swivel stud into the stock.



Fig.9-8. Once the stud is screwed in tight, the quick detachable swivels are snapped into place.

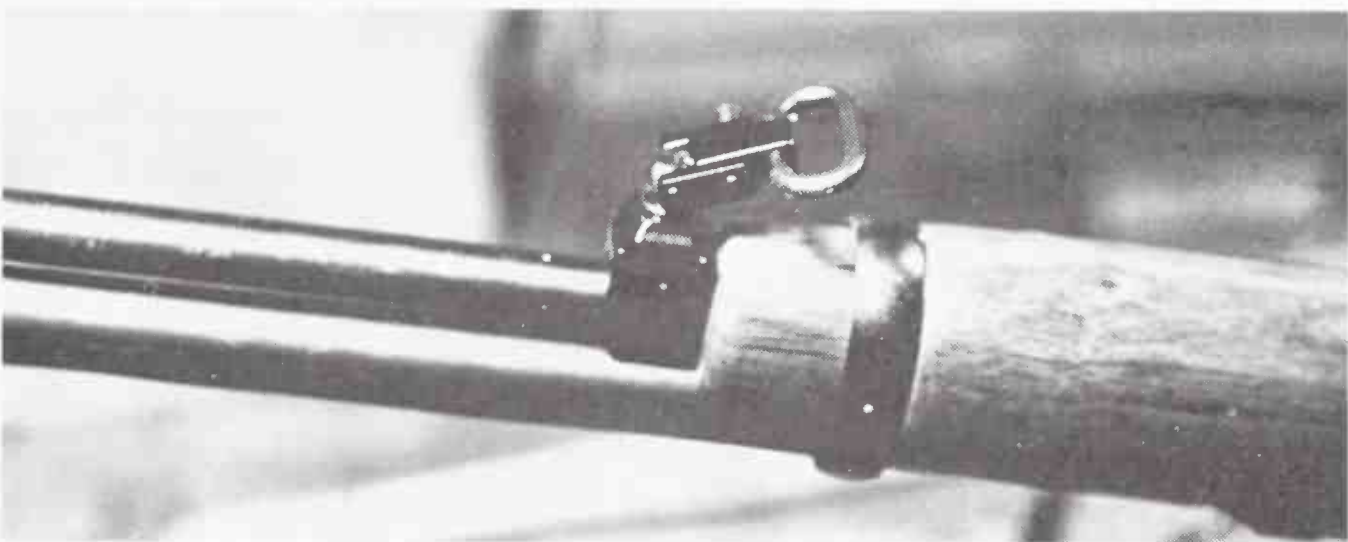


Fig. 9-9. The forward sling swivel for this Winchester Model 9422 is installed by clamping it around the magazine tube.

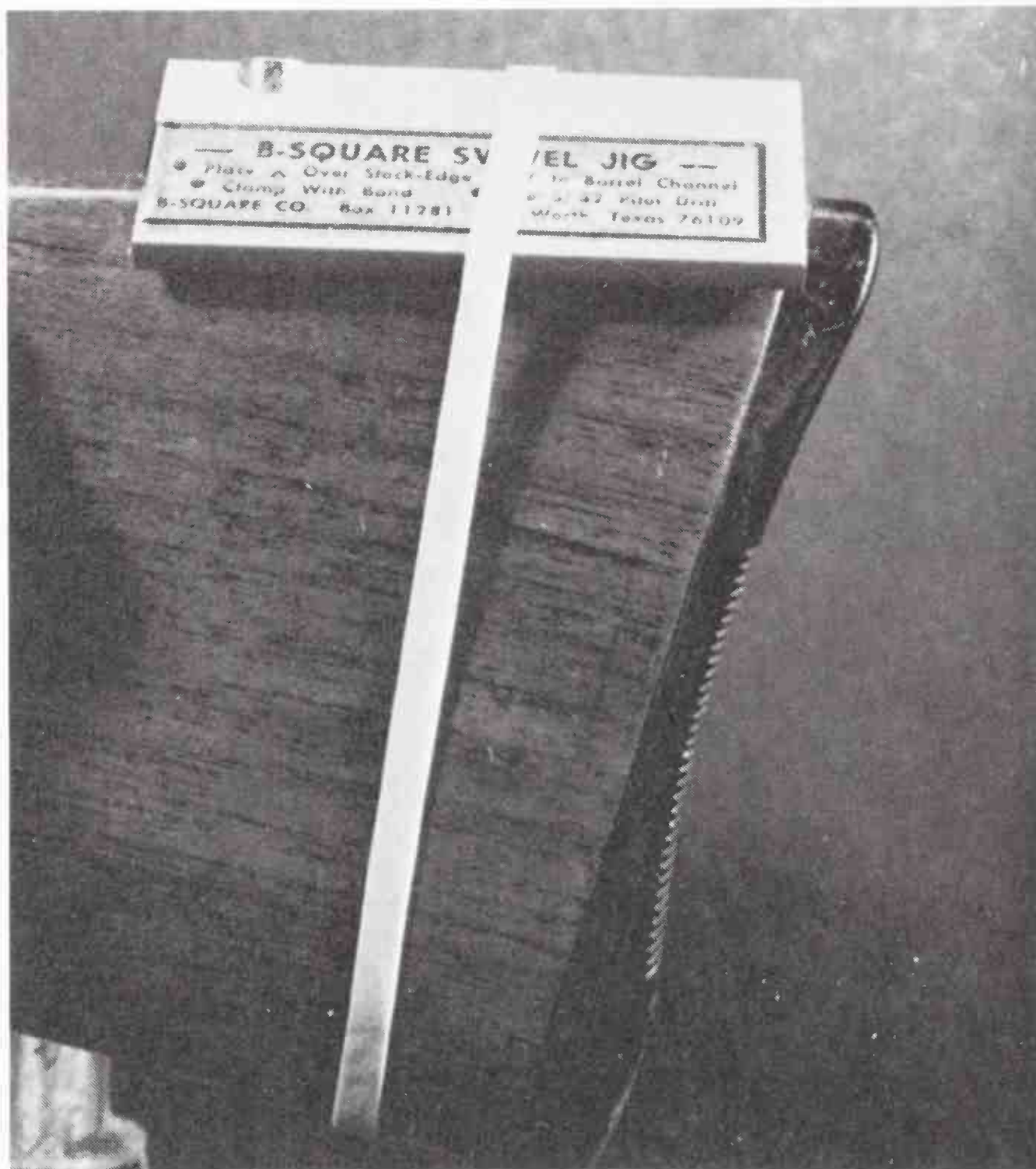
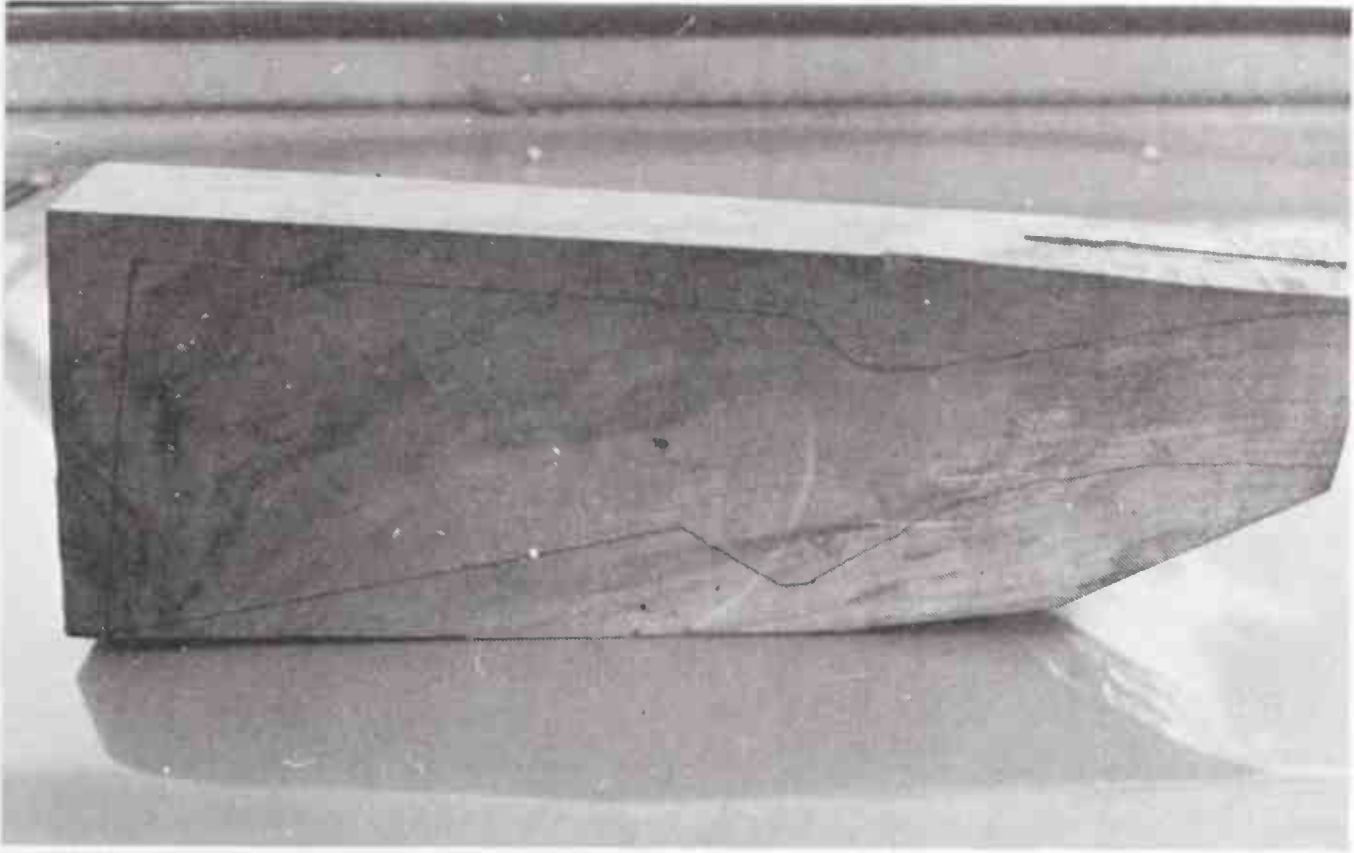


Fig. 9-10. B-Square Swivel Jig is a big help in drilling holes for swivel studs.

of the hole to accept the stud, and countersink the inside to accept the nut. Be absolutely certain that no part of this forearm installation touches the barrel as if it does accuracy will be affected greatly. Grind off some of the screw if necessary.

On certain firearms with tubular magazines, like the Winchester Model 94, Marlin 336, Winchester 9422, the forward sling swivel is mounted in a different way. One method is to use a clamp that fastens around the magazine tube as shown in fig. 9-9. If you obtain the proper size fitting, the installation is fast and simple. Merely loosen the retaining screw, position the clamp in the desired lo-



**Fig. 9-11.** Shaping a gunstock from a solid walnut blank is a little beyond the capabilities of most amateurs.

cation, and then tighten screw. Just make sure you have a proper fit. Also check the tightness of the retaining screw from time to time.

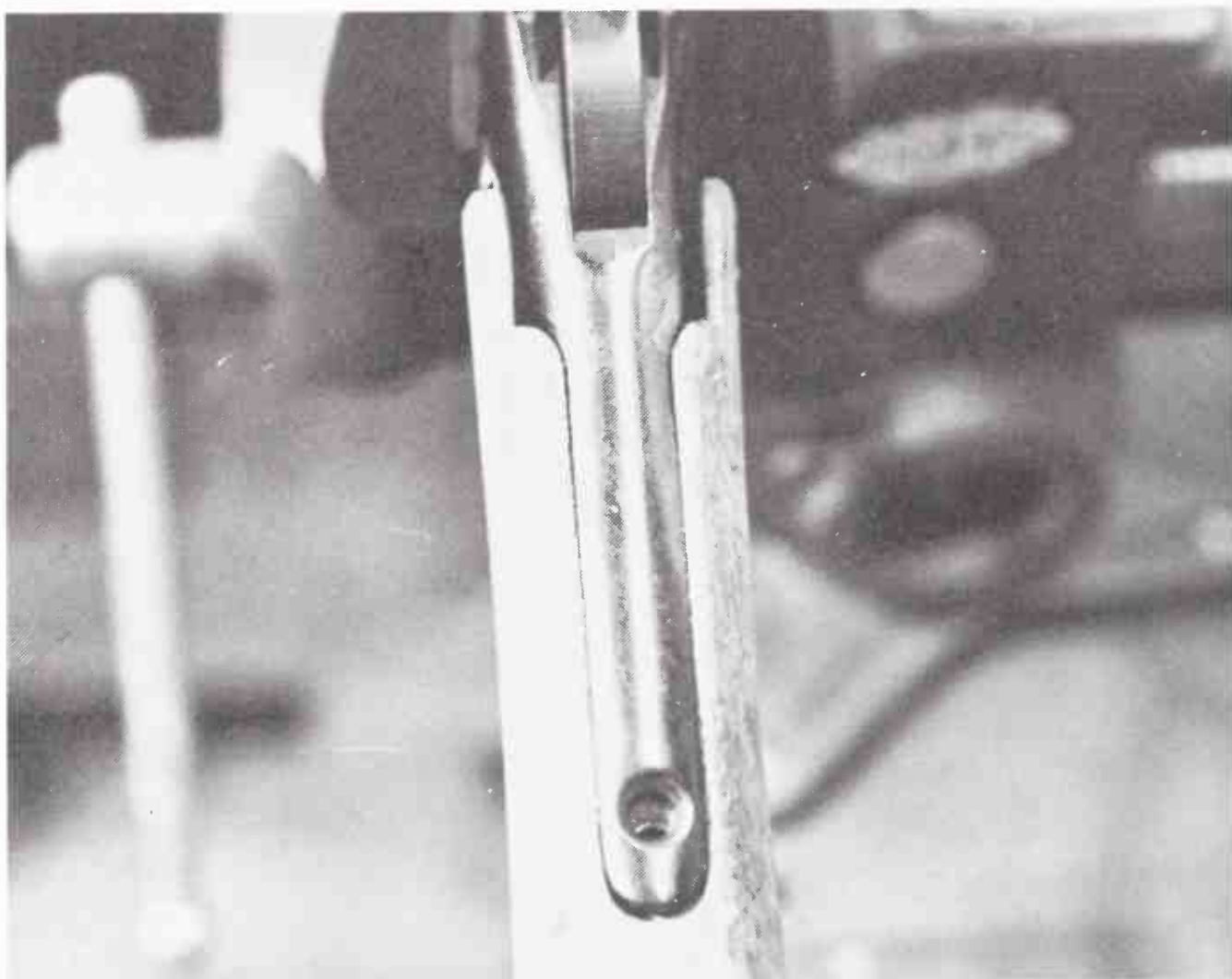
## **INSTALLING SEMI-FINISHED STOCKS**

Unless you are very talented in woodworking techniques, do not attempt to carve out a complete gunstock from a walnut blank. While it is true that many professional-quality gunstocks emerge from amateur's basements, most beginner's attempts end up as expensive kindling. On the other hand, an amateur who has woodworking tools and the patience to do careful work, will find the installation of a semi-finished or semi-inletted stock very rewarding.

Two of the largest suppliers of semi-inletted stocks are Bishop and Fajen; both have excellent stocks at reasonable prices. Neither, however, has stocks that you can merely drop a barrel and receiver into. All require a certain amount of fitting and you must have inletting tools to accomplish this.

The secret to obtaining professional results with a semi-finished stock blank is the constant fitting of the metal parts to the wood with slow and careful removal of excess wood. This is the only way to achieve the desired results.





**Fig. 9-12.** This is a semi-inletted stock blank from Reinhart Fajen. Note that there is an excess amount of wood and that the tang screw holes do not line up.

To accomplish a good metal-to-wood fit, you will need some means to show where excess wood must be removed. One way is to smoke the metal parts all over with soot from a smoking kerosene lamp or use inletting black available from gunsmith suppliers. Or mix your own formula by combining vaseline with lamp black oil paint, available at any hardware store. Paint all metal parts that will touch the wood with this blackening solution, and try the stock for fit. Any high spots on the wood will be indicated by the black from the metal parts. Carefully remove the wood indicated by the black marks. Don't take away any more than the black spots cover, and only make very shallow cuts.

As the work progresses, choosing which tool to use for certain applications should become easier. The barrel inletting rasp will be used, of course, to clean out channel; the chisel and gouge will be used to remove wood from the sides where the receiver fits into the stock; and final touch-up and cleaning will be done with the bottom-

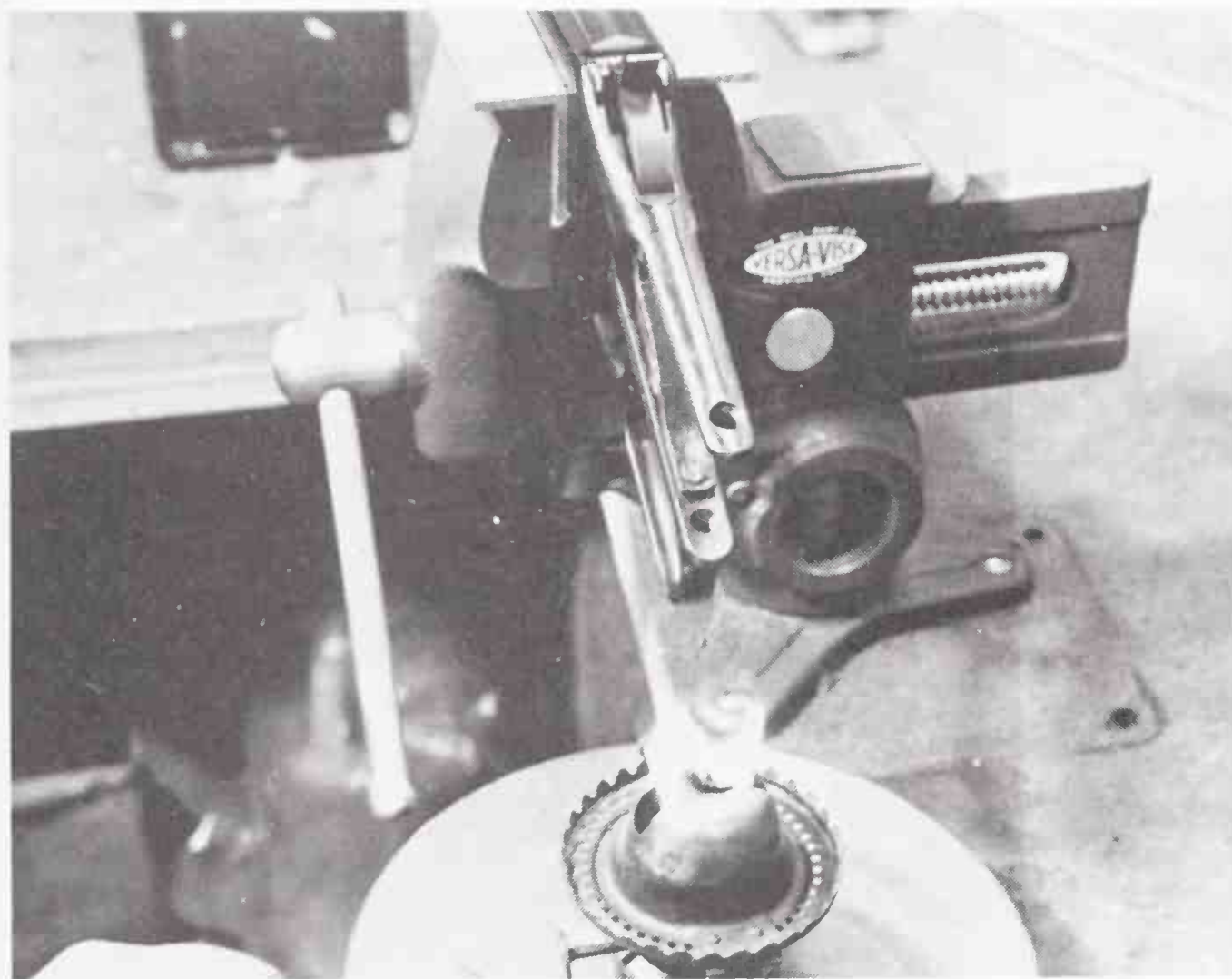
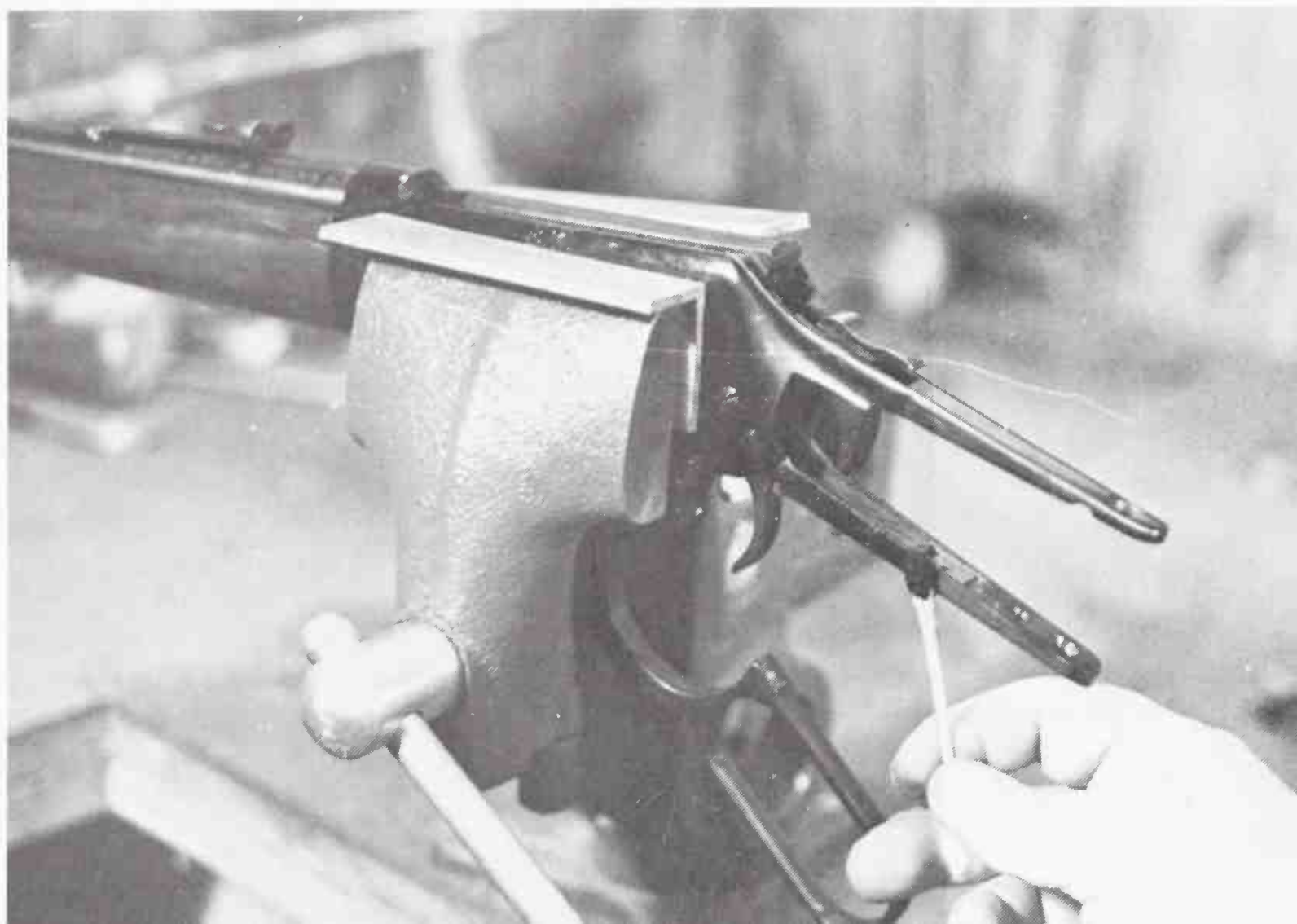


Fig. 9-13. Kerosene lamp used to smoke metal parts so that high spots on wood can be detected.

Fig. 9-14. Inletting black is the blackening solution normally preferred by professionals.



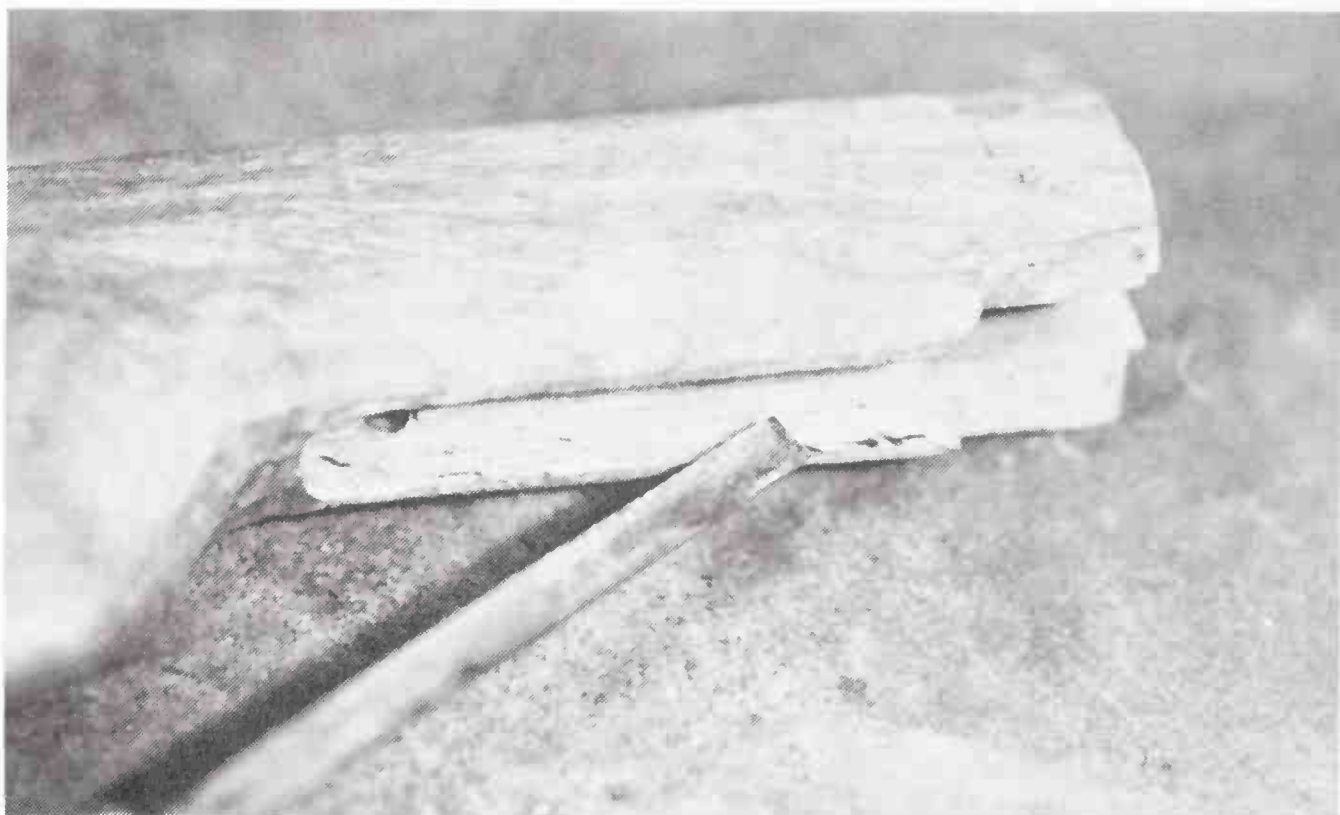


Fig. 9-15. The first trial. Note the black marks on the wood stock blank. A little wood is taken away and the stock is tried again for fit. This procedure is repeated until a perfect fit is obtained.

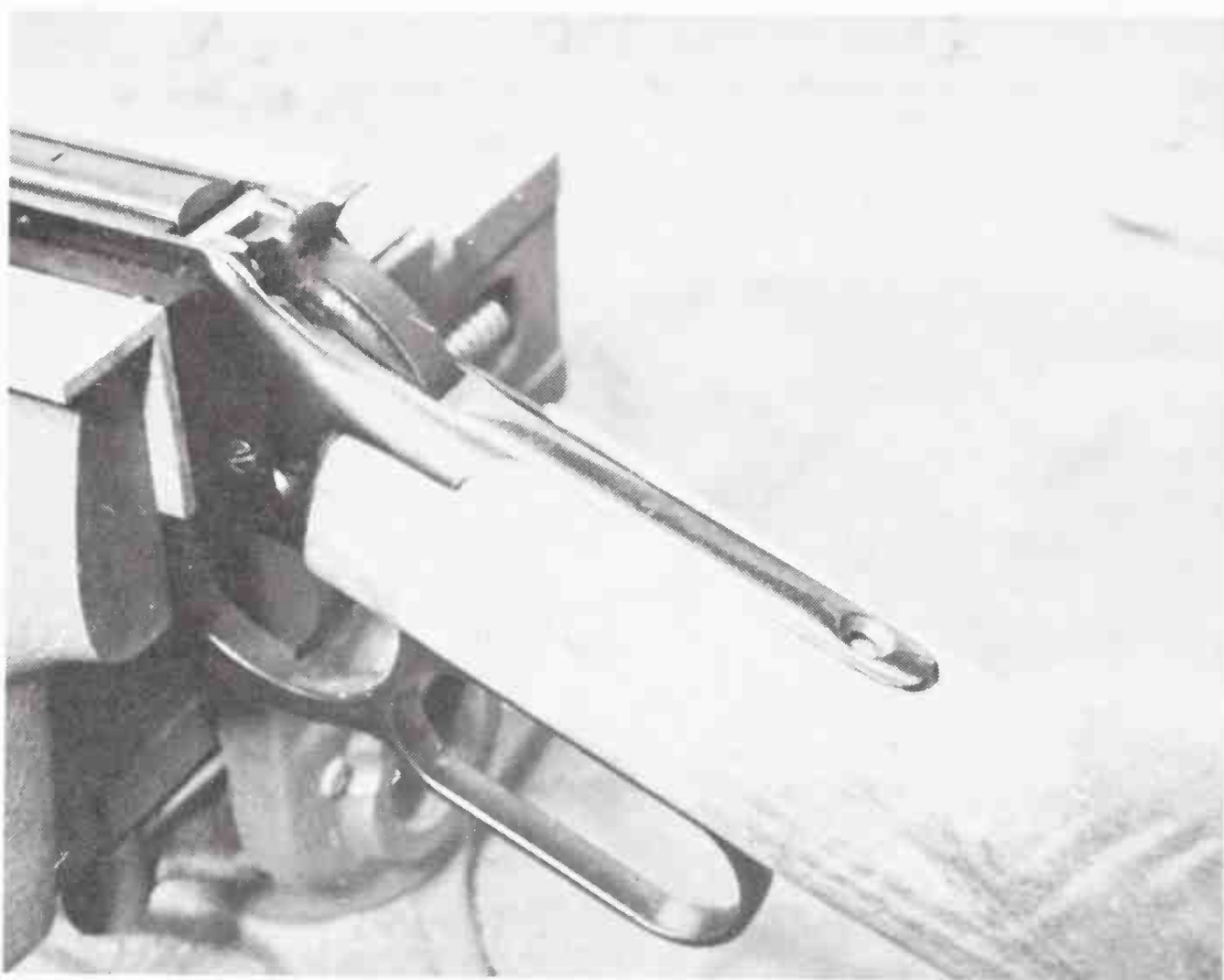


Fig. 9-16. After a dozen tries, removing wood each time, the butt stock is shaping up.



ing file. The word of caution here is to practice on scrap pieces of wood before jumping in on the finished product. Proceed with caution, removing a little wood at a time. Remember, once the wood is gone, it cannot be replaced—at least not very easily.

Keep all woodworking tools sharp at all times. You cannot hope to obtain a fine metal-to-wood fitting if your tools are not sharp.

When inletting stock blanks for firearms, I have found that the little Dremel Moto-Tool, which uses a rotary rasp, speeds up the work considerably. After trying the stock for fit, I merely touched the high spots with the rotary rasp and they are removed. I continue fitting and removing high spots or excess wood until the fit is perfect. The average semi-inletted stock takes about two hours using this method. Of course, I still use the basic woodworking tools also.

Most stock blanks come with a relatively fine exterior shape and require only minimal shaping and sanding before the final finish may be applied. The stocks from Bishop usually have a little more wood on them, often enough to allow some minor changes in appearance to suit your own taste. Fajen's stocks are shaped almost to final dimensions and require very little finishing on the outside.





# **Checkering**

A BEGINNERS FIRST attempt at checkering is usually somewhat less than perfect. In spite of straight lines and good intentions, many of the diamonds formed in the wood will not be geometrically correct. But do not let this chill your enthusiasm in the least. With a little practice, you will be making perfectly shaped diamonds in no time at all.

Checkering is the process of cutting diamond-like patterns on the grips and fore ends of rifles and shotguns, and on the grip plates of handguns. Usually the patterns are formed by cutting crossing lines into the gunstock with the hand tools described in this chapter. Manufacturers and some gunsmiths use special checkering machines that make the process faster and easier.

There are three basic styles of checkering found on firearms in use today. American checkering is the type most often used on gunstocks made in the United States prior to the time when manufac-



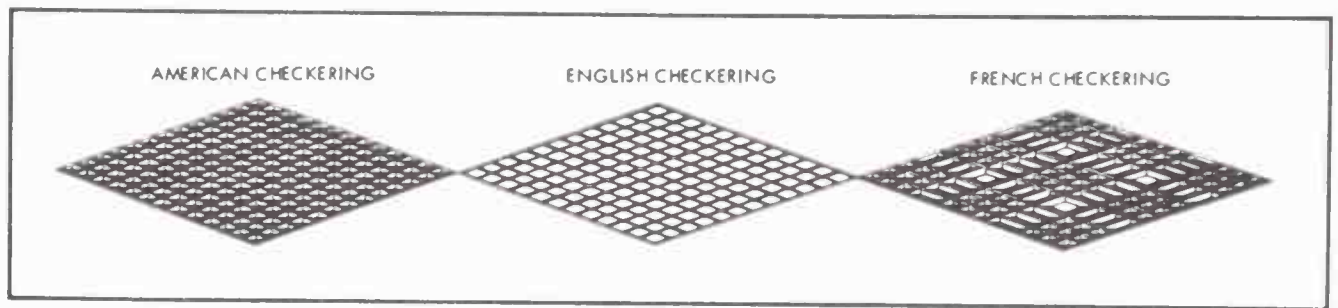


Fig. 10-1. Examples of various checkering designs.

turers began burning checkering patterns into the wood to save labor. In American checkering, lines are first scored lightly with a special woodcutting tool using guidelines to form perfectly shaped diamonds in the pattern. The lines are gone over again with a "V" tool to deepen the cuts and bevel the edges of the diamonds.

English checkering is similar to American checkering. In English checkering the lines are cut for American checkering, but no "V" tool is used to bevel the edges. Therefore, the diamonds are left flat. This type of checkering can be found on all types of shotguns, but mainly those manufactured in England and Europe.

French checkering is sometimes referred to as "Skip-line checkering" and is the type often used on fine custom-made guns to give them a more distinctive look. It is achieved by using two different width spacing tools. A regular spacing tool is used to cut three lines, then a spacing tool with twice the width is used to cut one line, then three more regular width lines are cut, and so on. The effect may be varied by changing the number of regular lines cut, the number of lines skipped, or both.

Before starting a checkering job, there are a few tools that must be made or purchased.

## CHECKERING CRADLE

Gunsmiths are famous for inventing ways of doing things, and therefore it is difficult to find two gunsmiths who checker a gunstock exactly the same way. However, most will agree that you must have some means of holding your work to obtain good checkering patterns. A checkering cradle makes the work so much easier, and the results so much better. The most important advantages of a good checkering cradle are:

1. It leaves both hands free so that you can checker with one hand and rotate the stock with the other as you are cutting

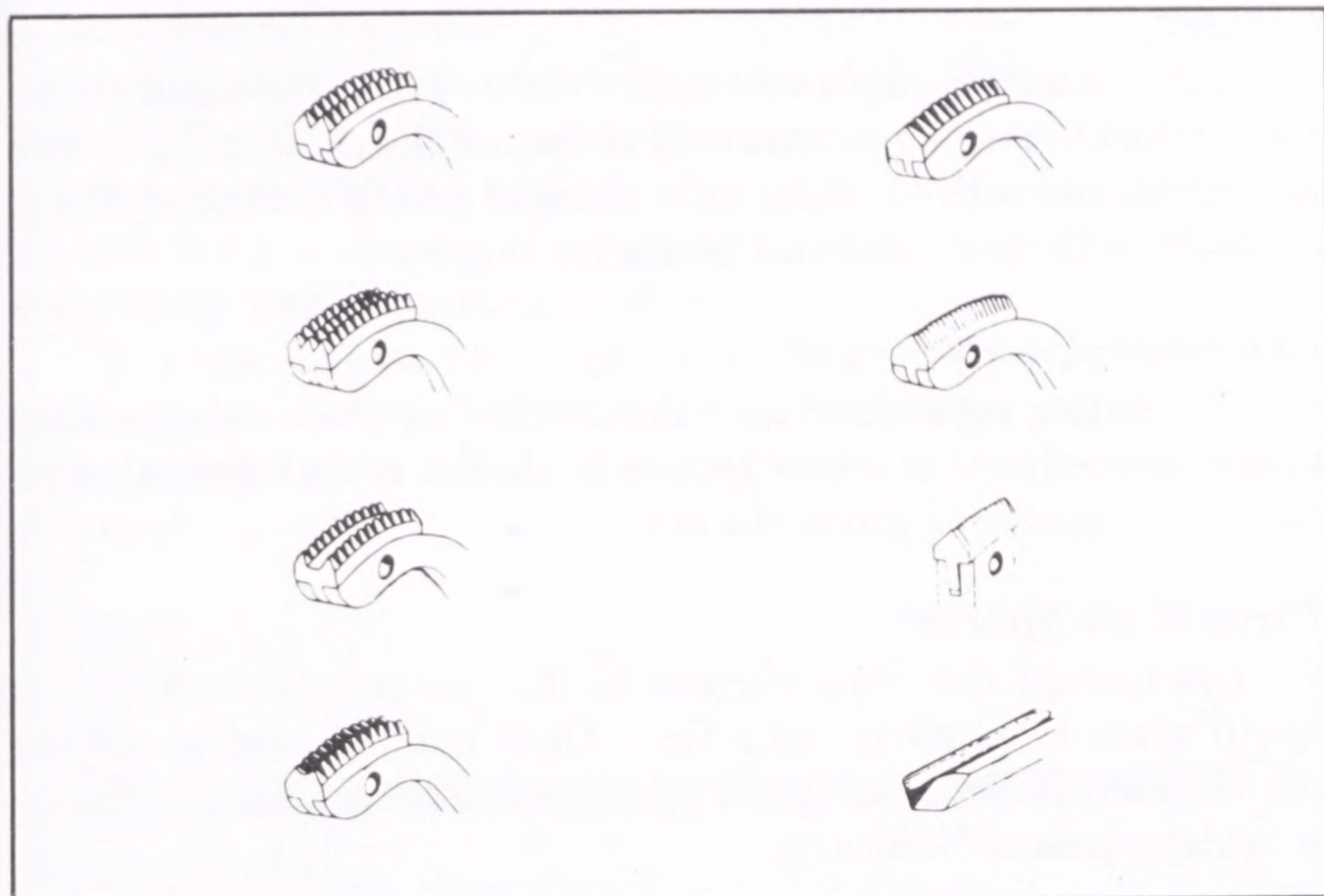


Fig. 10-2. Various types of cutters used for checkering.

lines—keeping the work area at the most convenient and controlled position. This eliminates the task of trying to work around corners of a stationary stock which makes it next to impossible to keep the line straight. If you move the cutter in a straight line and rotate the stock accordingly, you have a better chance of ending up with correctly shaped diamonds.

2. A checkering cradle that is held securely will not wobble. Anything less will end up in crooked lines and irregularly shaped diamonds.

The construction of a checkering cradle is relatively simple: anyone capable of working on firearms should be able to build one. However, if the material is not readily available, purchase a ready-made one from Brownell.

## CHECKERING TOOLS

There are several checkering tools available. But you may be better off to buy one of the kits available. I have tried Gunline Checkering tools with good success and also those manufactured by Dem-Bart. Both are well worth the money. Here are the cutters you'll find to be handy. See Fig. 10-2.

***V-Edger***

This is a single-edged tool used to score the outline and guidelines of the checkering pattern and to deepen the checkering as well as to finish the outline where only a single groove is desired. These are made with 60-degree and 90-degree angles.

***Two-Edge Spacer***

This cutter is used to space the checkering lines one groove at a time. One edge cuts a new groove while the other rides in a previously cut groove to guide the cut.

***Three-Edge Spacer***

Use this for the same purpose as the two-groove cutter except it will space two grooves at a time. Or it may be used to cut one groove at a time with two edges riding in two previously cut grooves to achieve greater accuracy.

***Ship-Check Cutter***

This cutting head is designed for spacing double width lines such as used in French checkering patterns.

***Border-Vex***

Use this to cut an attractive convex border around the checkering pattern like on the pre-1964 Winchester Model 70 rifles. One edge of the tool rides in the scored outline while the other, and the arched partition between, cuts the border on the outside of the checkering pattern.

***Pointer-Long***

A fine-toothed finishing tool used to bring the diamonds of the pattern to a point and to finish the outline. Available in 60- and 90-degree angles.

***Pointer-Short***

A fine-toothed finishing tool used on patterns requiring short radius maneuvering. Also made in 60- or 90-degree angles.

***Veiner***

Use this for outlining and for tight corner work, particularly on more elaborate patterns.



### Miscellaneous Cutters

Besides the various cutters just mentioned, there are three other tools that will be helpful in checkering new patterns or recutting old ones. A checkering riffler is used by many checkers and stock-makers for pointing-up checkering, cleaning up damaged or old checkering, and for cutting borders.

The bent needle file is specially designed for checkering. The cutting edge of the "V" is 90 degrees which helps prevent the tool from tipping to one side or the other when pointing up 90-degree diamonds.

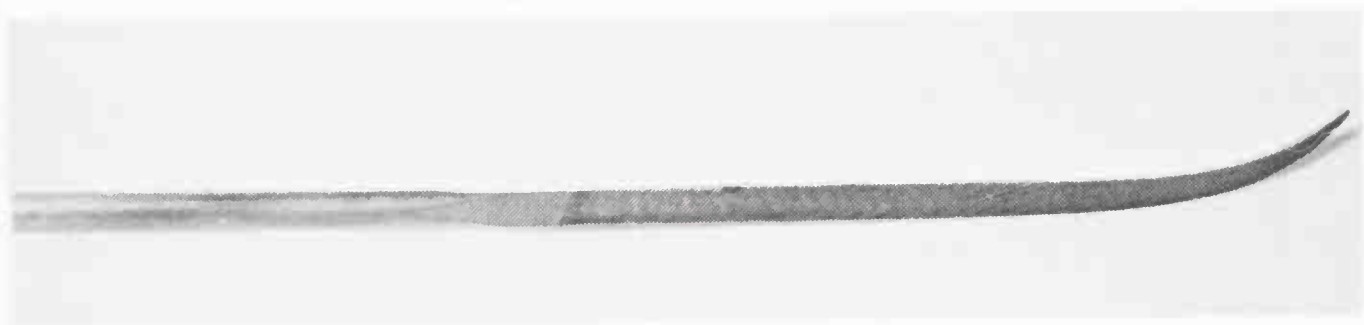
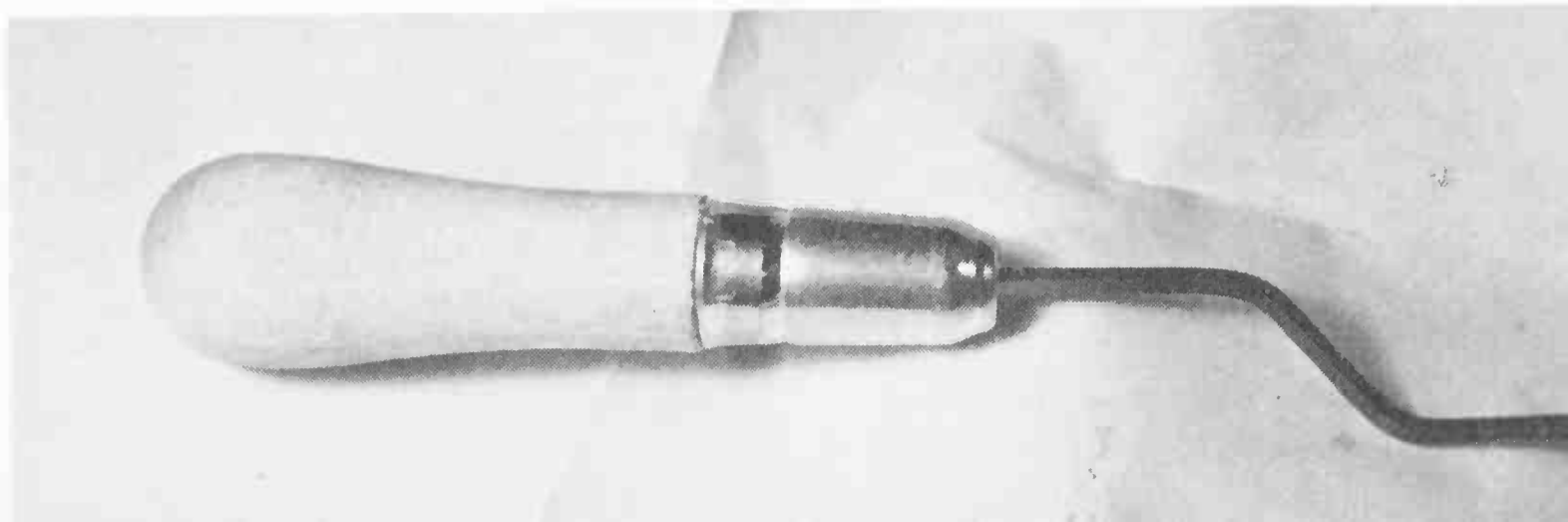


Fig. 10-3. The cutting edge of the bent needle file is shaped to help prevent tipping the tool from one side to the other when pointing diamonds.

Another checkering file, the 3-square, 60-degree bent, is used for pointing up new checkering and cleaning out old. It is the only tool that many professionals use to get true, sharp diamonds in their checkering patterns.

Some years ago, Monty Kennedy, nationally known checkering expert, designed a checkering tool called the "jointer". Its main purpose is to straighten out checkering lines which have gone astray, and to make layout and other lines used in checkering gunstocks really straight. When it comes to checkering, eventually all of us goof in one way or another. This usually means one of our lines goes off just a mite due to the wood grain, a change in density, or a false move. When this happens, nothing can help out more than the jointer.

Fig. 10-4. Monty Kennedy's jointer.



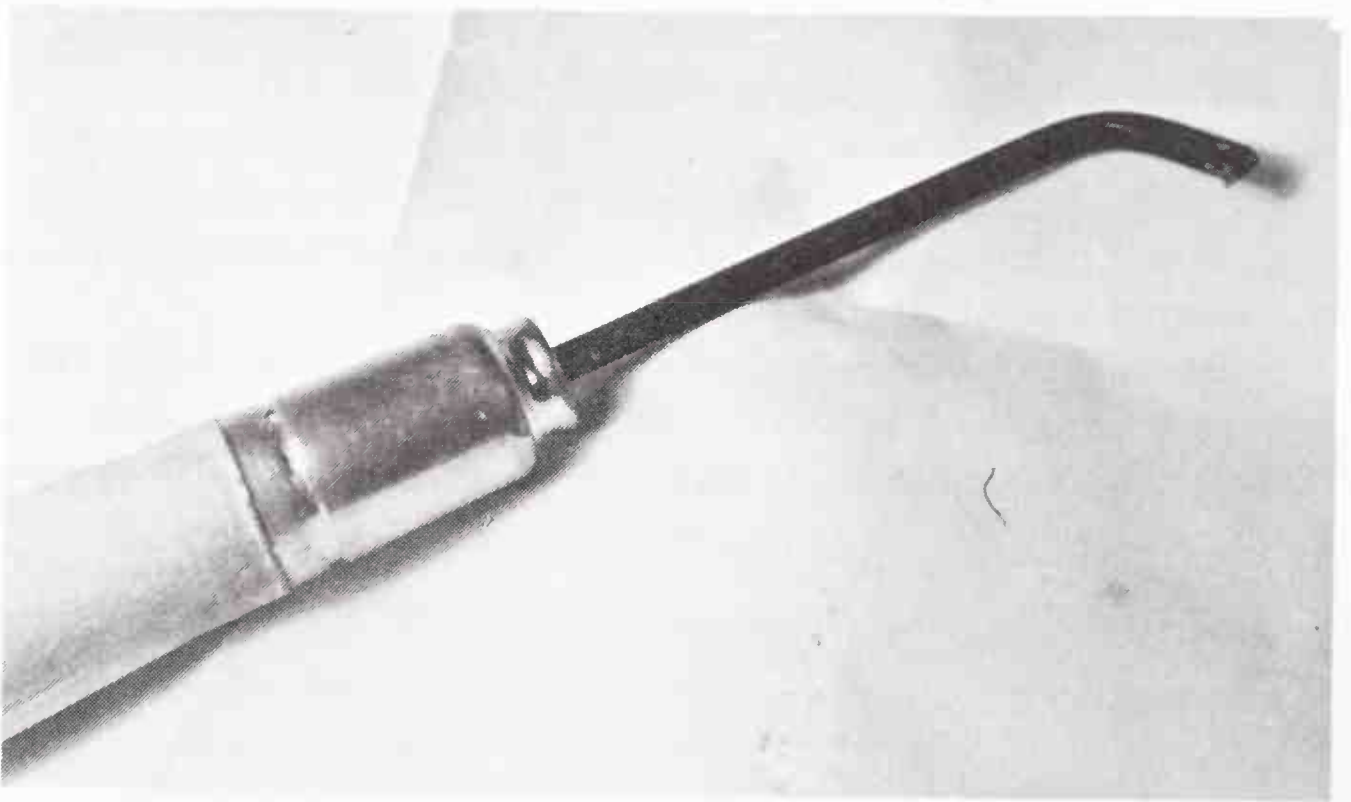


Fig. 10-5. Dem-Bart's S-1 tool is designed to get into tight corners and curves.

Another handy tool is Dem-Bart's Special S-1 tool, which is designed especially for getting into those tight corners, curves, and out-of-the way places. This tool cuts with a pulling motion rather than a pushing motion and is ideal for getting right up to borders and other tight places.

Checkering cutters come in different sizes designed to cut patterns usually in 16, 18, 20, 22, and 24 lines per inch. To check out an existing pattern that you want to duplicate, put a measure on the pattern and count the number of lines within the distance of one inch. To speed this measuring up, purchase a Brownell ChekRchex®. This gadget is a lines-per-inch measuring device that is easy-to-read and has templates for spacings from 16 to 32 lines per inch. To use, simply place the ChekRchex® over the pattern to be measured and match the lines on the proper scale. Because of its flexibility, it gives good accurate readings on flat or curved surfaces. A 4-inch ruler is also included.

In time, you may find other handy gadgets that will aid in checkering gunstocks; layout guides, checkering pounce wheels, dual cutters. But for the present time, you will be able to get along nicely with the tools already mentioned. In fact, you do not even need all of these to get started. Get a Dem-Bart Starter set of tools and the Leader set offered by Gunline Tools and you are in business.

The extra assortment of tools mentioned just makes work a lot easier.

LAYOUT OF CHECKERING PATTERNS

You may want to design a checkering pattern—perhaps using the book, *Checkering and Carving of Gunstocks* by Monty Kennedy (Stackpole Books)—or use decal patterns, such as the ones supplied by Stan De Treville, Box 33021, San Diego, CA 92103. Stan has about two dozen different patterns from simple to complex designs (fig. 10–6). They can be ordered direct or from most gunsmith supply houses.

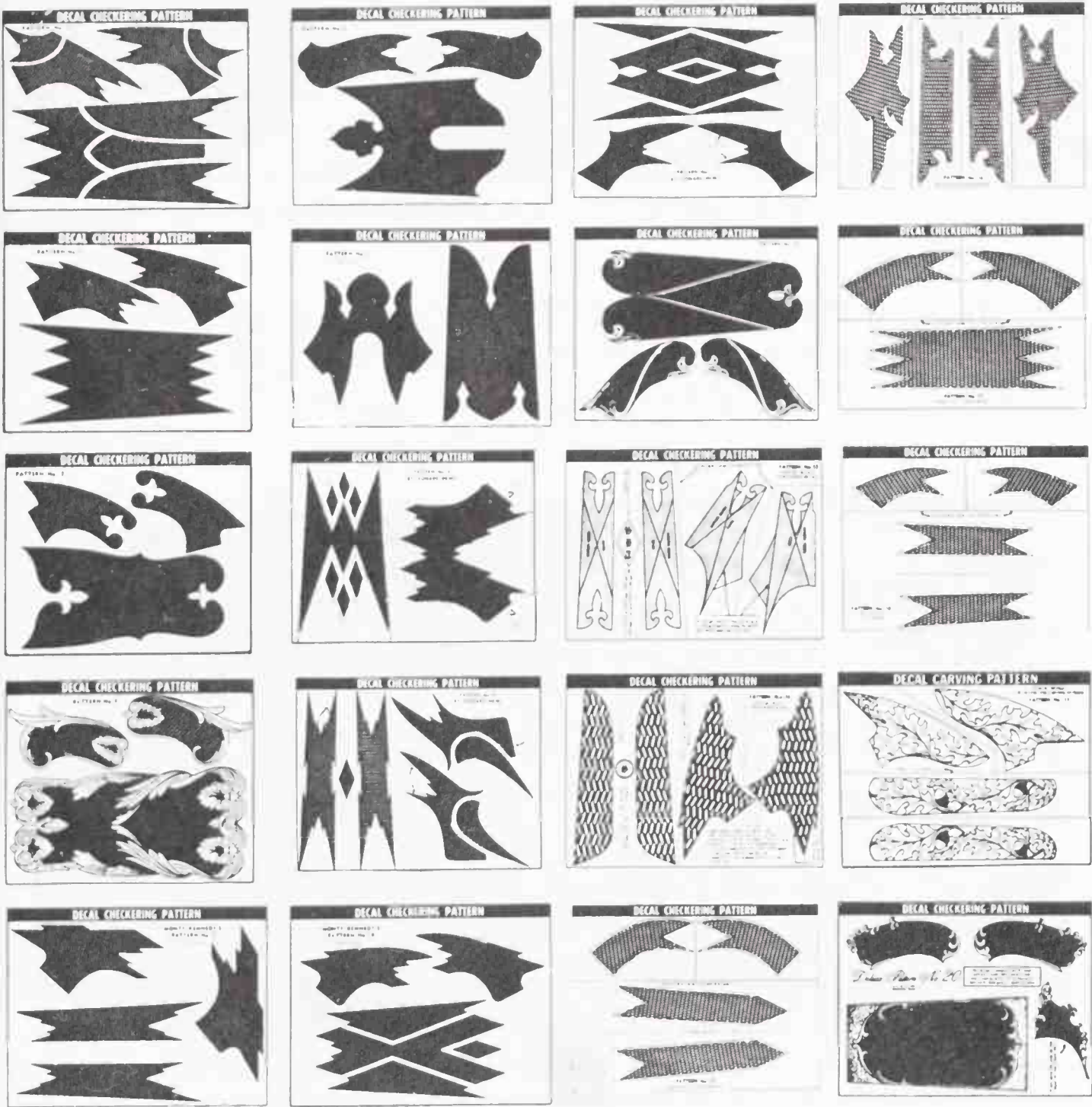


Fig. 10–6. Some of the decal patterns available from Stan de Treville.



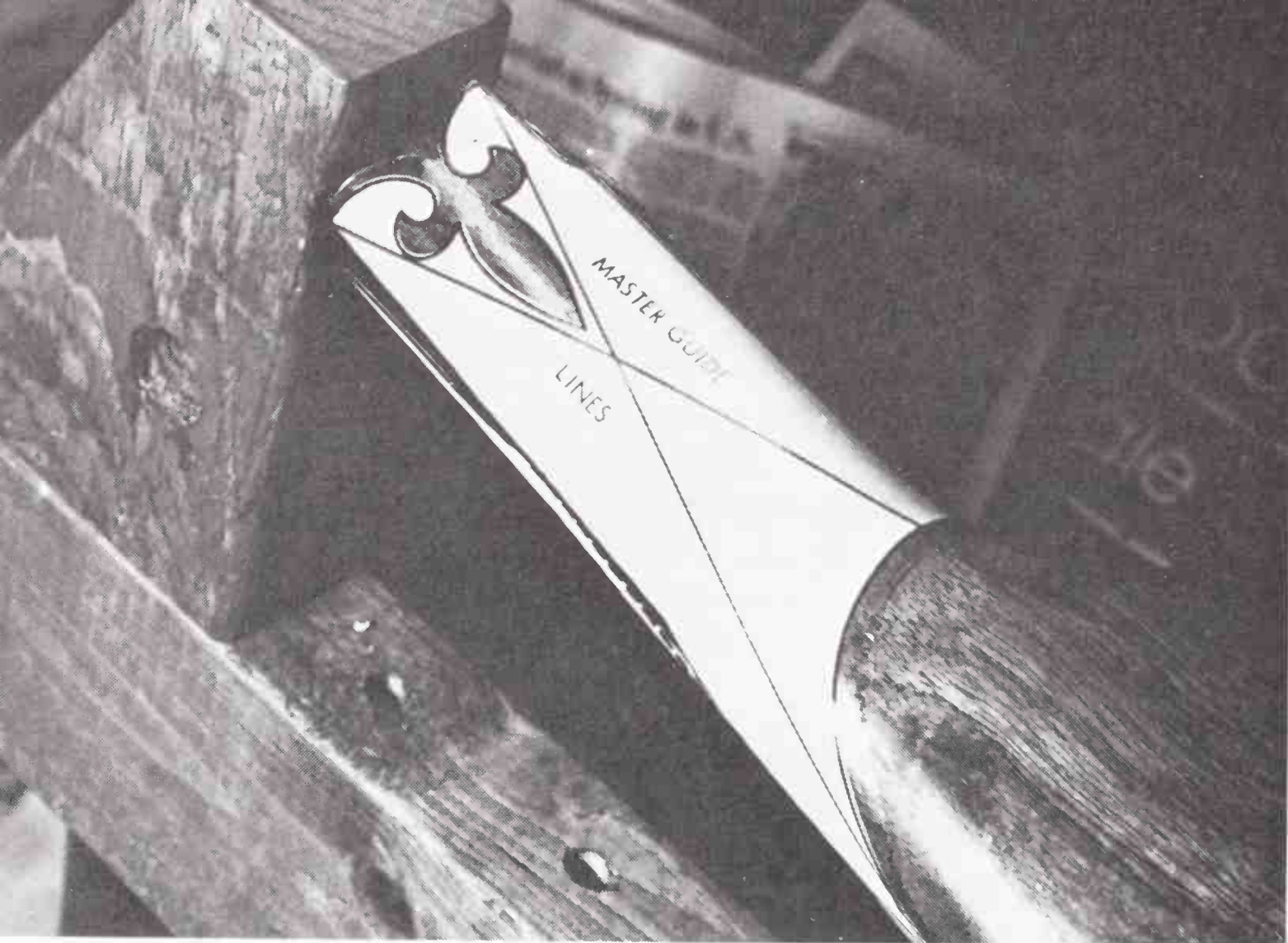


Fig. 10-7. After the decals are placed in water for a few seconds, they can be attached to the gunstock.

To apply the patterns, cut the decal pattern sheet apart on the dotted lines so that the forearm pattern and both grip patterns are separate. Soak them in water just long enough for the decal to begin to loosen from the backing paper. Dampen the areas on the gunstock

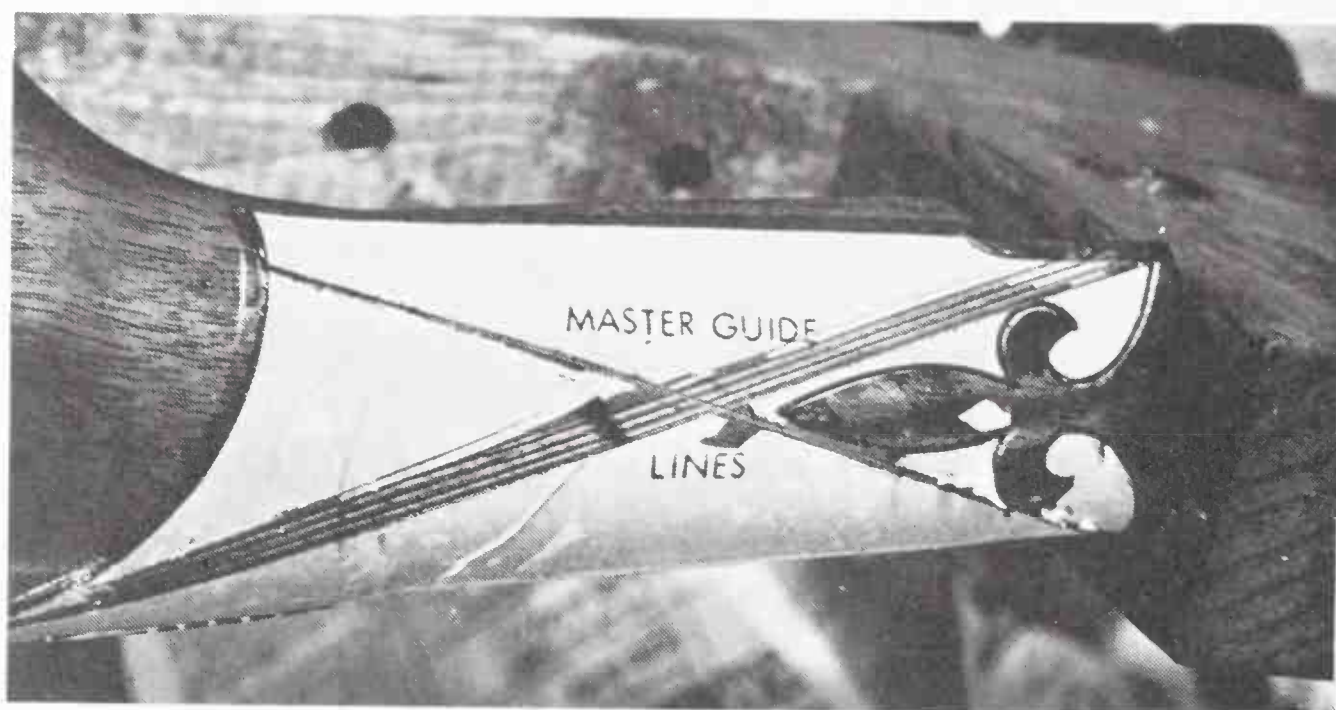


Fig. 10-8. Once the outline has been gone over with either an X-Acto knife or a veiner, lines are cut in one direction with a two-edge spacer, then the lines in the other direction are cut to form the diamonds.

where the designs are to go, and apply the decal by carefully sliding them off the backing paper into the desired position. Make sure the patterns on each side of the stock are in alignment, then swab them smooth with a clean cotton cloth and wipe off the excess water. Let the pattern dry thoroughly before attempting to checker over it.

At this point, checkering techniques may vary from person to person, but I prefer to first cut the outline with a sharp knife, such as an X-Acto knife. Use a flexible straightedge to guide the blade on straight cuts, and French curves where the lines curve. Then use a single cutting tool, the veiner, or a combination of both, to scribe the pattern outline and the guidelines for the diamond cuts. If the decal should become damaged during the checkering process, before the job is completed, you will still be able to complete the job since all of the outlines and guidelines are scribed into the wood.

Starting on one of the master guidelines, use a two- or three-edge spacer and make a cut, pushing the cutter in short see saw movements until the entire length of the line is reached. Be extremely careful not to go over the border lines—even if you have to stop a half inch before you get to them. Also, be careful not to let the spacing tool slip out of the guide groove already cut with the “V” tool or veiner. Care must be taken on each parallel cut because the grain of the wood, if running somewhat but not quite parallel

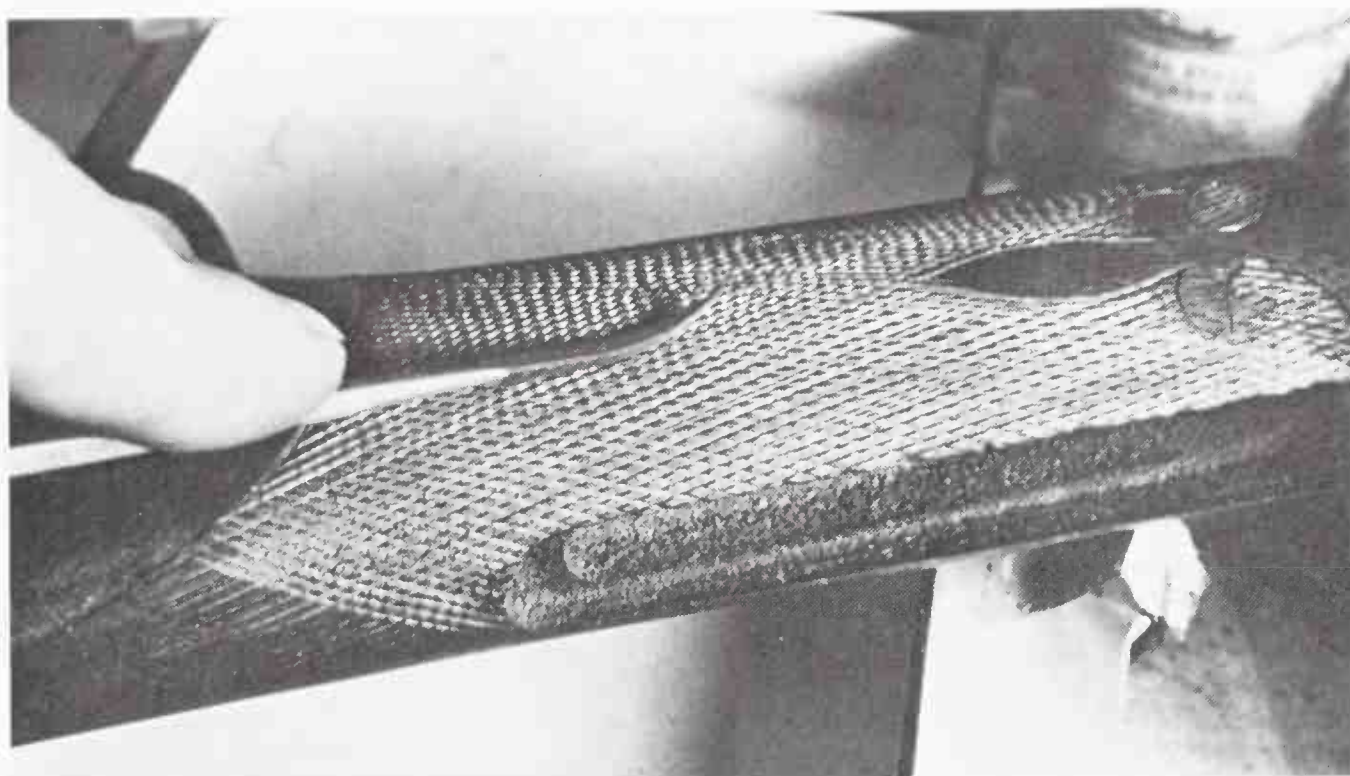


Fig. 10-9. Once the lines have been cut in both directions, the pattern is gone over with a checkering riffler to clean up lines and to point diamonds.



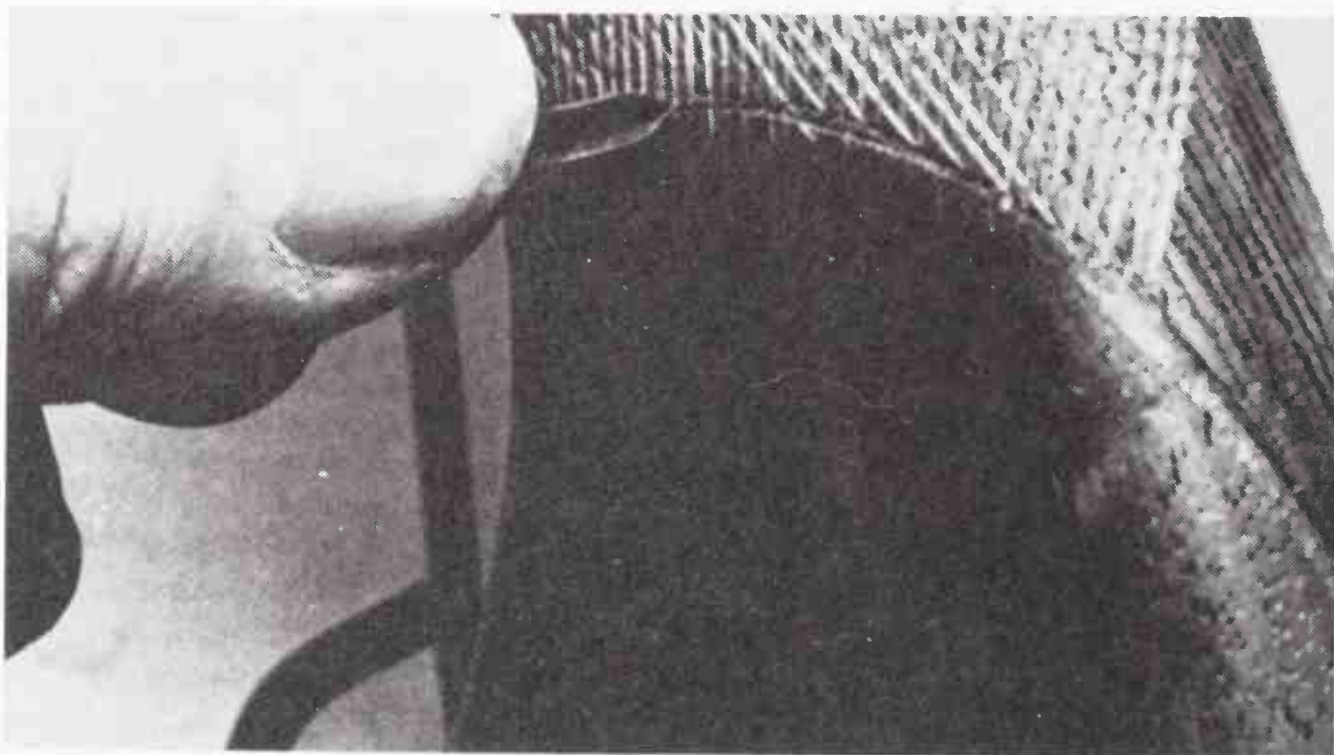


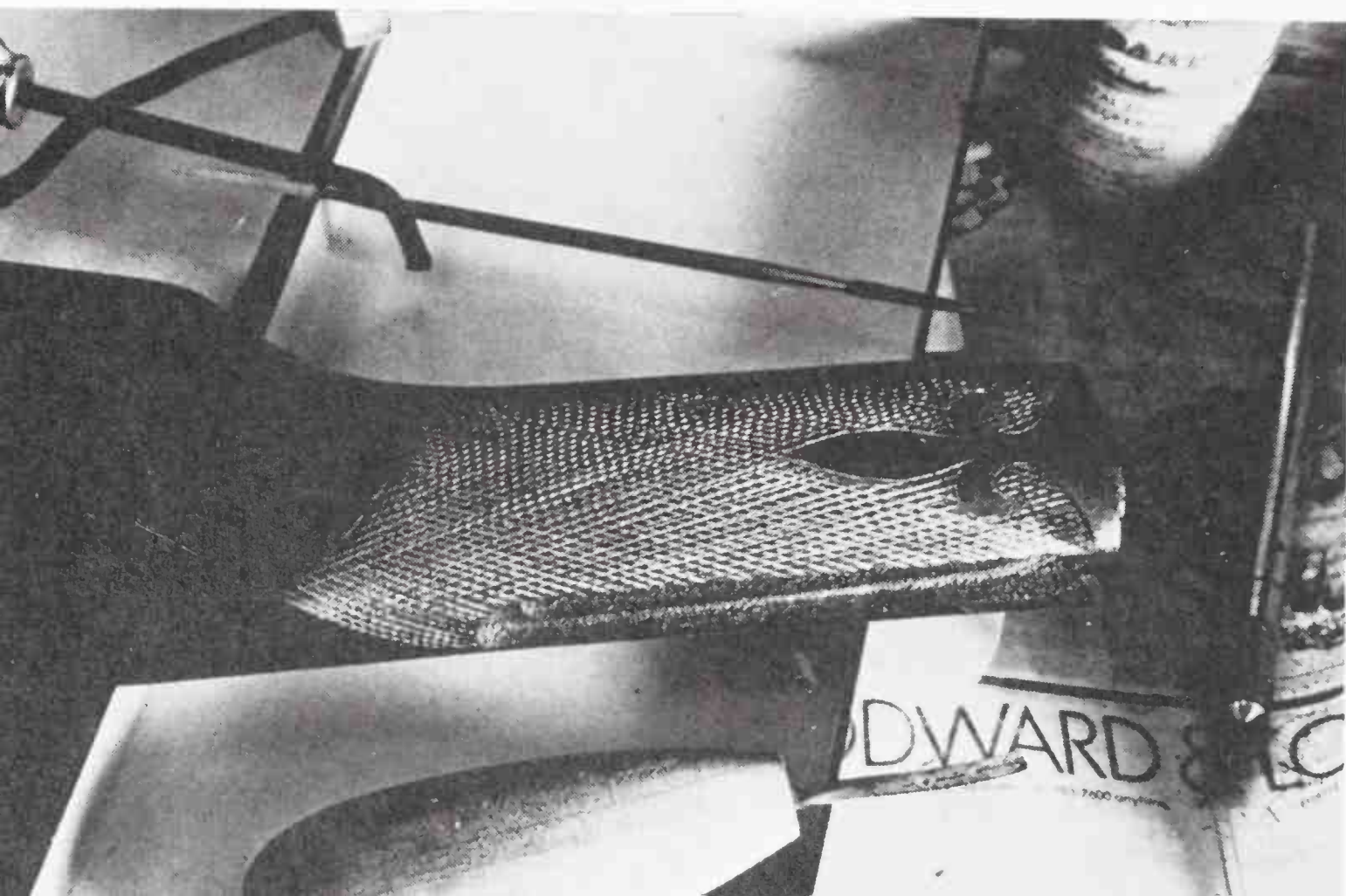
Fig. 10-10. A veiner is again used to bring out border and other lines.

to the line that is being cut, will have a tendency to lead the cutter off to one side or the other, making the spacing greater or less than it should be.

Some stock makers like to use three- and four-line cutters as much as possible because these cutters offer more lines to guide by, thus insuring that parallel lines are cut exactly where they should be with less chance of slipping.

Never try to cut the lines to their full depth the first time over;

Fig. 10-11. The job is finished.





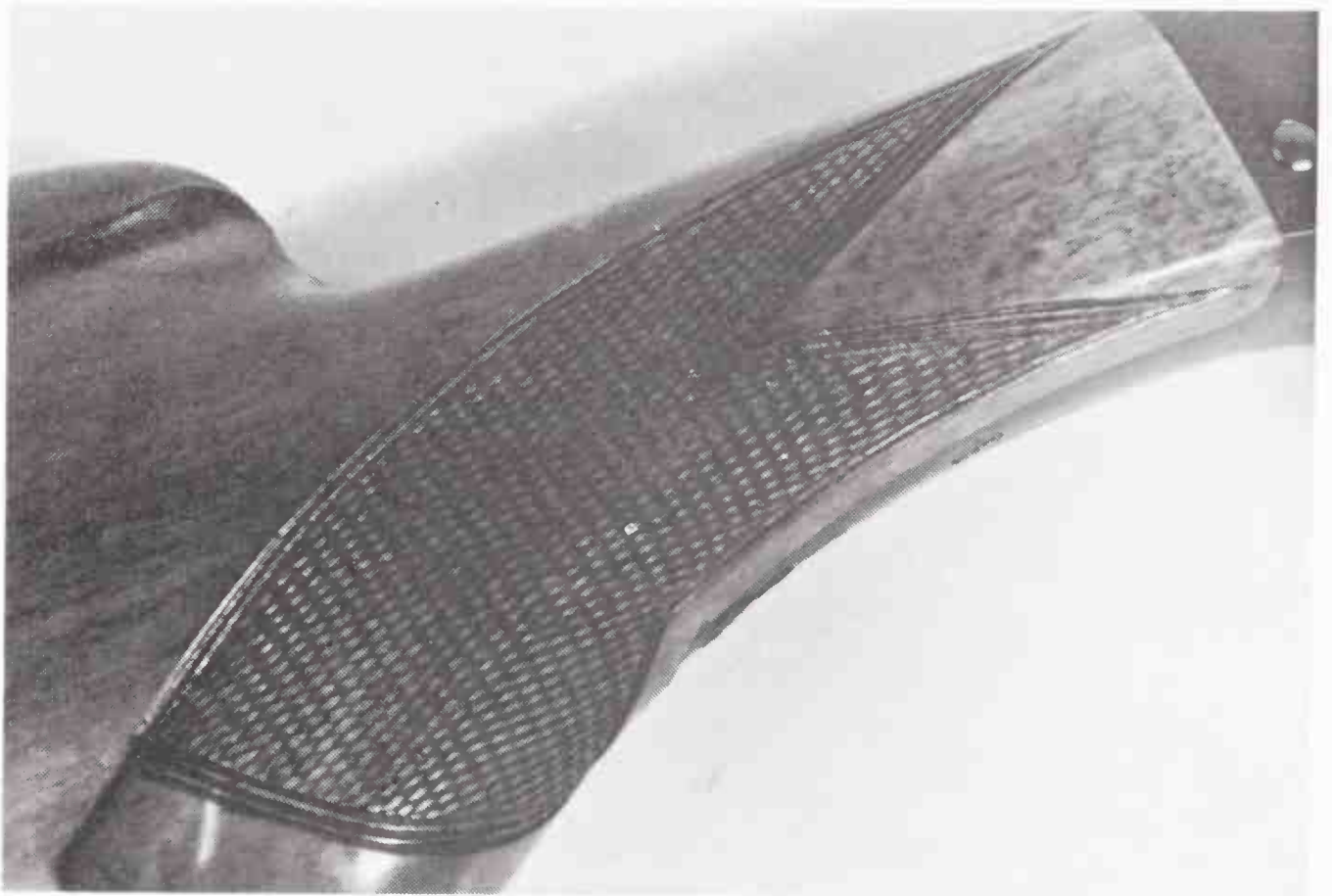


**Fig. 10-12.** Craftsman at Paul Jaeger, Inc. checkering a stock for one of their fine bolt-action custom rifles.

cut them down approximately halfway. When all of the lines are cut this way, go back over the job a couple of times and work the lines down to where they are about 85 to 95 percent complete. Then use a single-line finishing cutter or a bent needle file to bring all of the diamonds in the pattern to a sharp point, when using the American style of checkering. For English checkering, leave the diamonds flat.

Begin by practicing several patterns on scrap pieces of wood before attempting a good gunstock. This practice includes work on curved surfaces, like on an old baseball bat. Obtaining lines on a curved surface may seem difficult at first, but if you take a flexible steel rule with straight edges and wrap it around a curved surface like the pistol grip on a gunstock, it will be straight. It may look like a cork screw, but it is straight to the surface of the wood. Now getting the cutter to follow this straight line is more difficult—it takes practice.

Don't rush the job. When a line is cut, be sure that it is right, regardless of how long it takes to do it. Over-anxious beginners



**Fig. 10-13.** Checkering pattern on Browning Auto-5 Shotgun uses a heavy 3-line border.

sometimes learn the hard way that avoidable mistakes are made in a few seconds but take hours to correct.

Finish the job by sealing the checkering area with a stock preparation. This may be applied with an old toothbrush. Dem-Bart Stock Finish gives a desirable low sheen finish. Dem-Bart also furnishes a Sealer-Filler, but this should not be used on the checkering; only on the rest of the stock when refinishing the entire stock.

Besides the pleasure derived from checkering gunstocks and dressing up your guns to obtain that custom look, checkering is functional too. It provides a non slip grip for your hands that is especially useful when the stock is wet.

## **RECUTTING OLD CHECKERING**

In refinishing gunstocks, you will eventually come across a stock that needs refinishing and has checkering that needs restoring. Refinish the stock, using only a toothbrush with finish remover on it to clean the old checkering pattern; do not sand the areas that are checkered. A wire brush can be used to remove some of the old finish between the diamonds. When the patterns are as clean as possible,

use a bent three-square file to point up and further clean the old checkering pattern. Apply just enough pressure (and it will not take much) to keep the cutting edge of the file centered. Advance the tool in a push-pull motion keeping the arm close to the body to maintain straight lines. Keep the grooves free of dust by blowing or brushing. Then clean the entire recut pattern with a toothbrush and apply two coats of Dem-Bart Stock Finish, again with a toothbrush.





# **Ornamental Work on Firearms**

SOME GUN OWNERS like to dress up their firearms a little; that is, add distinctive features that make their guns stand out from the rest. Such work may include engraving, plating of certain parts, jewelers work of bolt or breech block, stock carvings, and gold lettering inlays. Most of these added attractions are for appearance only; few, if any, have any real functional value.

## **ENGRAVING**

Engraving and ornamentation of metal parts on firearms is not a job for everyone. It takes skill, patience, and a certain degree of artistic ability. Anyone who lacks any of these should concentrate on other phases of gun work. Once you have gotten started in engraving, the rate of progress and quality of work will depend entirely upon practice. In fact, learning to engrave on metal is much like learning to play the piano. Those who practice diligently and reg-

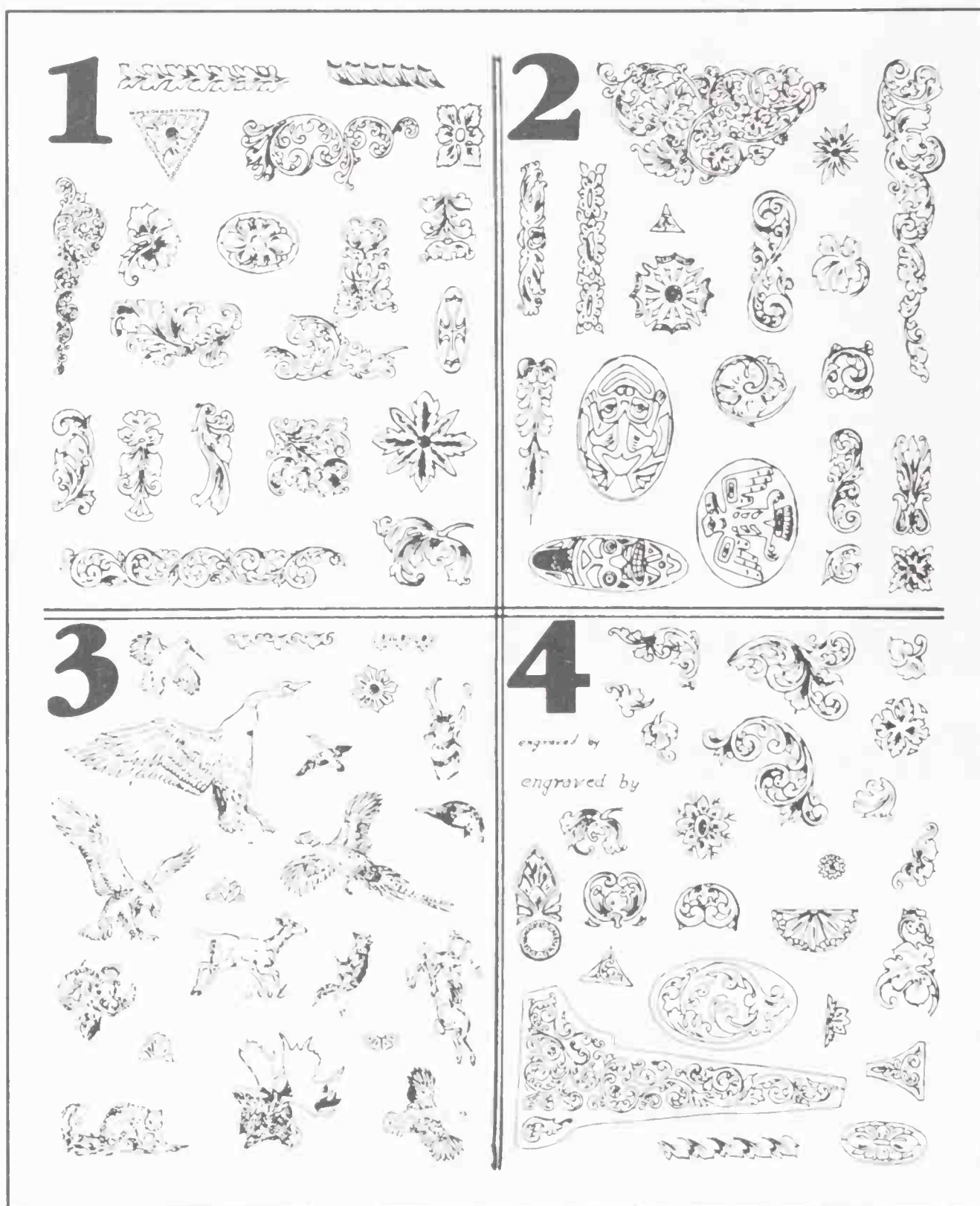


Fig. 11-1. GRS Engraving pattern stamps are a little expensive, but a great aid for the beginner.

ularly seem to progress faster and better than those who do not. But remember, you must first have a certain degree of natural talent, if you plan to be a real expert.

The first thing to purchase is the book *The Art of Engraving* by James B. Meek. This book simply tells you how to engrave simply and in layman's terms. Furthermore, it assumes that the reader knows nothing about engraving. You start by learning to draw



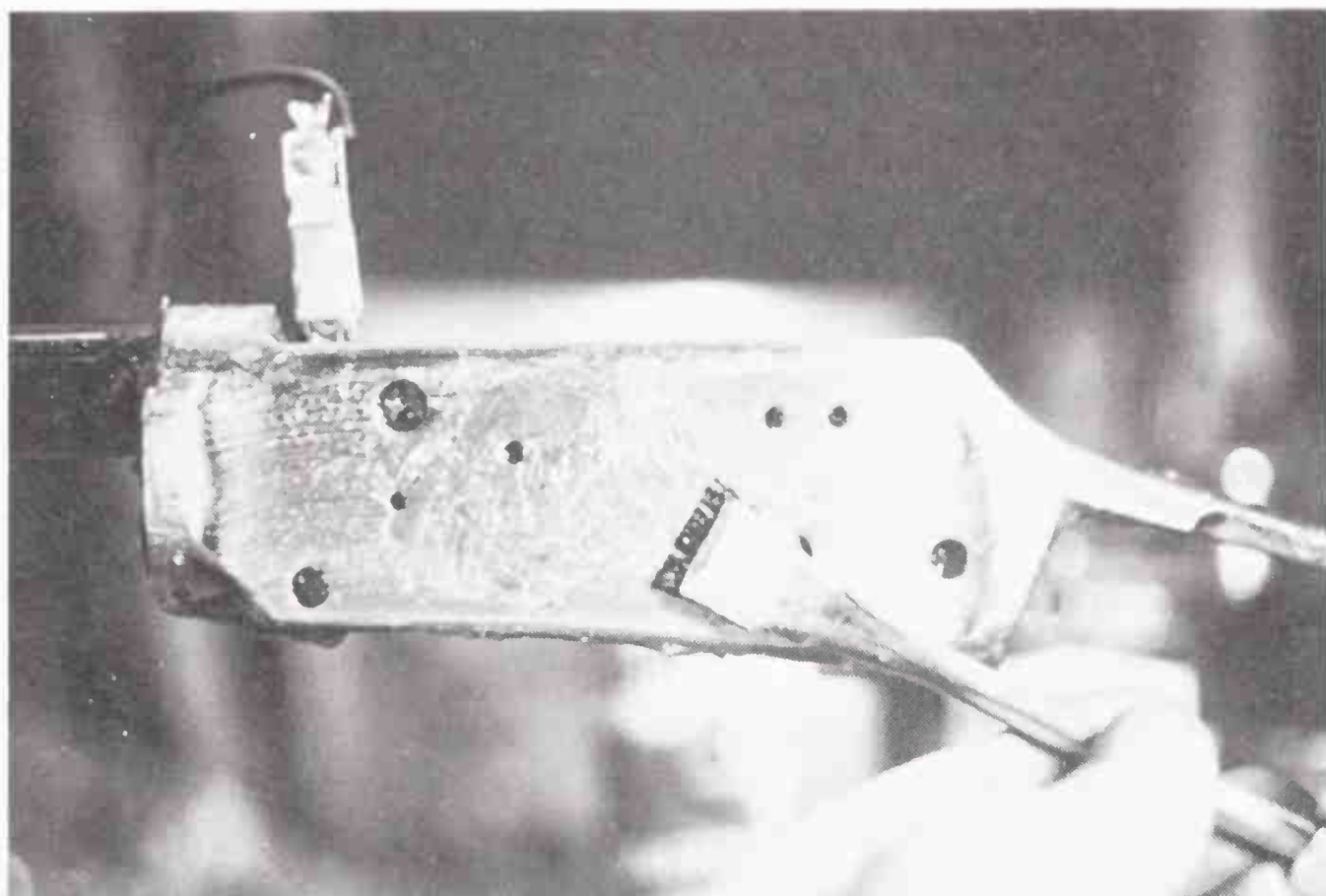


Fig. 11-2. Texas Planters' Gunsmith Plating Kit is a good choice for the beginner. The plating solution is merely brushed on with the aid of batteries.

scrolls and layouts, then cut practice plates until you are sure enough of your ability to actually proceed to designing a pattern, transferring it to a gun, and cutting it into the steel. It includes hundreds of original engravings, designs, and layouts by the author to explain specific points and techniques.

Then get Neil Hartliep's Beginner's Engraving Kit and several practice plates to work on. (All of these items, including the book, are available from Brownells Inc.) With these items, you should quickly find out if gun engraving is for you.

## PLATING

Many handguns, and certain parts of long guns, are nickel-plated for appearance and to guard against rust and corrosion. Conventional methods of plating are often beyond the means of the average gunshop, not to mention the hobbyist, and this operation is often bypassed. For touch-up jobs, however, Texas Platers Supply Co. (2453 W. Five Mile, Dallas, TX 75233) offers a kit especially designed for the home gunsmith. All you need, besides the kit, are two or three 1 1/2-volt ignition batteries. Two will suffice, but three will afford speedier results, although it is harder to get an even coat when working with three batteries. The batteries are connected in

series with the negative (−) terminal connected to the gun or part, and the positive (+) terminal connected to the brush holder or handle. The brush is then dipped into the solution (nickel, gold, brass) which is brushed onto the surface. Of course, all surfaces must be clean, and several coats will have to be applied to obtain a durable finish.

When touching-up nickel-plated revolvers, brightly polished steel that is first plated with copper and then with nickel will have a better finish than if the nickel is applied to the bare metal. It is also easier to blend when done in this way.

## GOLD INLAYING

The traditional method of inlaying gold and silver in lettering on firearms is similar to the way a dentist fills teeth. A quick-setting amalgam is mixed. A powder form of gold or silver is mixed with mercury into a thick paste. At the proper consistency, the amalgam is sort of like fresh putty. This amalgam is then forced into the lettering lines under pressure of a hammer and inlaying tools much like those used for engraving.

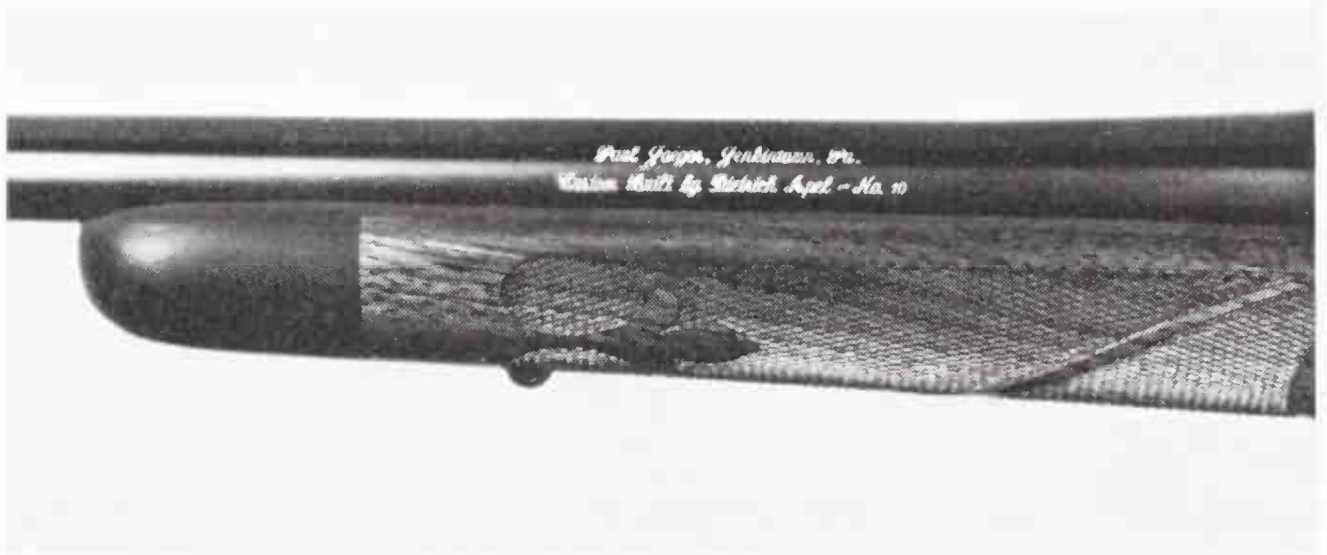


Fig. 11-3. Custom-built rifle by Dietrich Apel of Paul Jaeger of Jenkintown, Pa. The inscription is gold inlayed.

An easier method is to use a brush-on inlay kit. The two kits currently available are Gold Lode Gold Inlay Kit and Bonanza Brushing Inlay in either gold or silver. The Bonanza Brushing Inlay is a do-it-yourself kit designed for the hobbyist. It enables you to fill engraving and lettering on all guns with an attractive gold or colored

fill. The kit comes with everything needed to fill the lettering on several guns.

Gold Lode, Inc. offers a 23 karat gold engraving inlay kit that can be used to enrich all engraving and lettering on firearms with genuine gold. Each kit contains enough gold inlaying material to do the lettering on several firearms and the four-step process is simple. Everything necessary for a complete job is included in the kit—gold crystals, Agent No. 1, brush, cloth, and dropper.

To use the kit, first carefully clean the area to be inlayed with a soft cloth and the No. 1 Agent to remove all oil, grease, and dirt. Then add Agent No. 1 to the gold mixture in the specified amount and mix with the brush until the mixture is smooth.

Brush a thin coat of gold over the section of the lettering or engraving and, before it dries, work the gold into the lettering with the index finger, at the same time trying to keep the mixture confined to the immediate area. Repeat this operation until the lettering is filled.

Wrap a portion of the wiping cloth around your index finger, dampen it with Agent No. 1 (not wet, but damp only). To make sure that the cloth is not too wet, apply a small amount of Agent No. 1 to the cloth, then apply the dampened section to a piece of paper towel to remove any excess. Gently work your finger and the dampened cloth over the inlayed area to remove the gold from the smooth sections, leaving the gold only in the lettering. A felt block is also provided with the kit to be used in the same way as the cloth to remove any gold from the hard-to-get-at areas.

After completing the entire area, examine the work carefully to make certain that no spots have been missed. Allow the inlaid area to dry for thirty minutes before polishing the area with a soft cloth.

## **SILVER AMALGAM INLAYING**

Even though checkering is the more popular way to decorate gunstocks, there are other ways—carving, inlaying, you name it. One decoration that is gaining popularity is silver amalgam inlaying of patterns on gunstocks. You can design your own or purchase one of the many offered by Stan De Treville of San Diego, CA. If you choose the latter method, position the decal pattern on the butt end of the stock, allow it to dry, and proceed as follows:



1. Use an X-Acto knife or other razor-sharp knife to cut the outlines, slightly undercutting to better retain the silver. Then use a triangular needle file to smooth the edges of the cuts.
2. Mix the silver powder with mercury according to the directions to make the amalgam. To save a lot of time and confusion, ask your family dentist to show you how to mix a batch. After squeezing the excess mercury out through a cloth, the amalgam is forced into the cuts and tamped until firm.
3. When the silver hardens, sand it down until it is flush with the surface of the wood.
4. When all is flush, refinish the stock as described in chapter 9.

Remember that mercury is poisonous and should be kept out of the reach of children and pets. Also, wear latex gloves while working with the mercury to prevent possible poisoning by absorption through the skin. Your local druggist or dentist will be able to tell you where to purchase silver and mercury and might even give you some pointers on how to mix them for best results.

## **GUNSTOCK CARVING**

Gunstock carving falls right behind gun engraving in difficulty. The work is easier, however, if you have artistic talent, lots of patience, good sharp tools, and time to practice on scrap wood before attempting a design on your firearm.

A set of stock-carving tools is not cheap. The starter set of Acorn carving tools listed in Brownell's catalog will cost you over \$50; a complete assortment is probably the best buy for a beginner. Then, as you progress in knowledge and ability, advance to more tools to make the work easier.

Most wood carving chisels are ground to shape, but do not have the final edge on them when you receive them. The first step in wood carving is to learn to sharpen your tools. Each must have a razor-sharp edge, which must be touched up often with a fine honing stone.

To get started, you must first decide upon a pattern to carve on your stock. You can design a pattern of your own, or use Stan De Treville's decals.

Secure the pattern to the stock with transparent tape, or if a

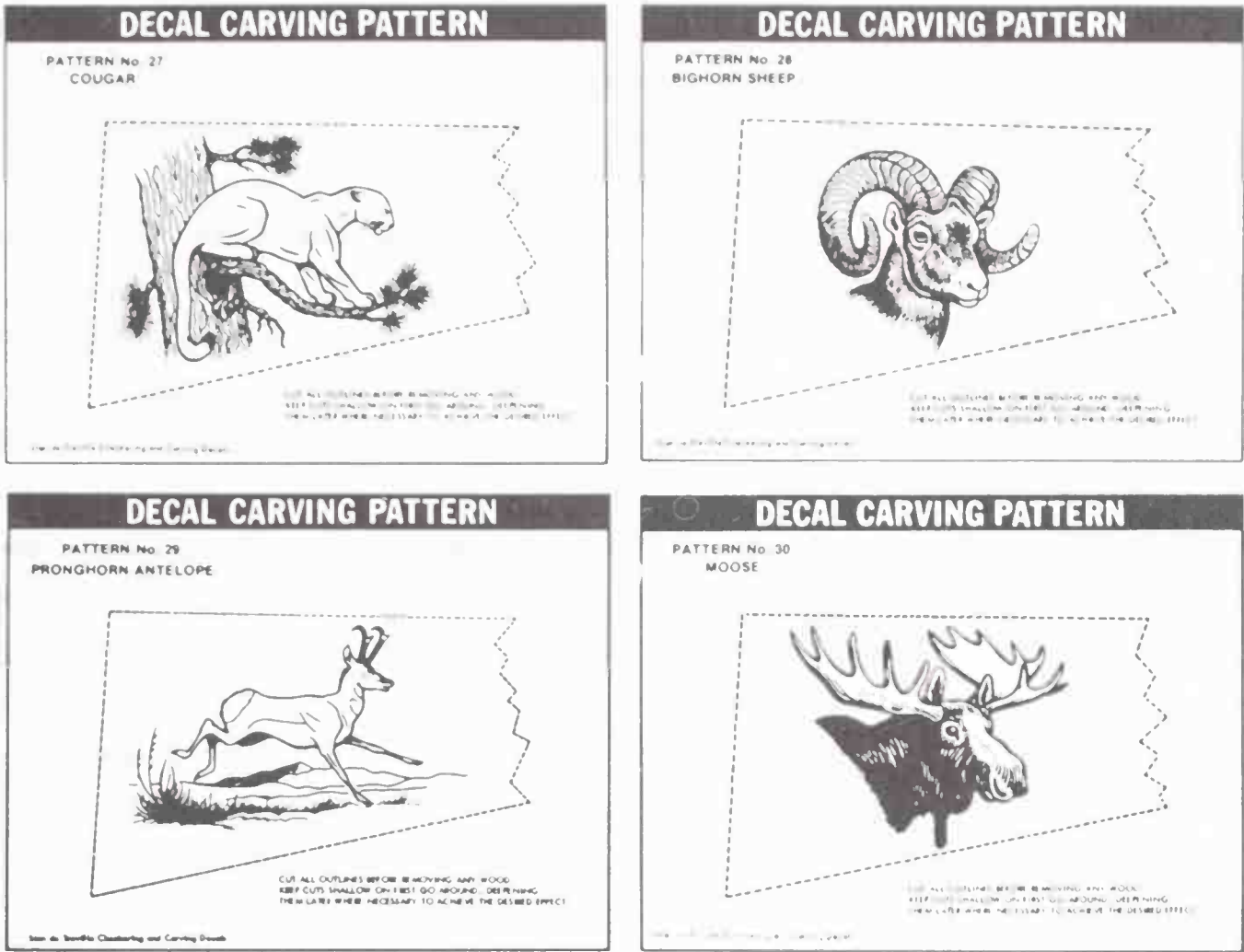


Fig. 11-4. Stock-carving patterns available from Stan de Treville to get the nonartist off on the right foot.

De Treville pattern is used, adhere it to the wood after soaking it in water for a few seconds. Once the pattern is in place, cut out the lines about 1/16-inch deep with an X-Acto knife or 60-degree veiner tool. This operation separates the design from the background.

Next use a 3/8-inch gouge and cut the background away from around the design up to the outer lines you just made with the X-Acto knife. To cut the background deep enough, go over it at least twice. Then go over the outlines again before once again deepening the background. The object is to have the subject, such as a running deer, high enough from the background to enable you to give it the proper relief.

This is where the going gets a little rougher. Depending upon the design you are carving, you will now be striving for lifelikeness and fine detail. This is a matter of practice and requires patience and perseverance. Work slowly and deliberately, determining where to take out wood and how much to remove. The main thing to be

concerned with is not to take out too much. You can always cut away more, but you cannot put it back once it is gone. When completely satisfied that you have done your best work, as far as detail and relief are concerned, clean your work up and finish the stock.

To finish wood carvings, you will need some small jeweler's files and perhaps some fingernail sanding boards. With these instruments file or sand out the tool marks on the entire carving, including the background. Then use tiny pieces of sandpaper, working your way to the finest grades, to further smooth out your work.

You can leave the background smooth, following the general contour of the stock; or use a stippled background. To create the stippled effect, tap the background at random with a nail, center punch, or similar sharp object.

At this point, it may be necessary to remove the old finish from the entire stock in order to finish the carving. However if you are careful, you can blend a finish on and around the carving to match the old—especially if you know what finish was used on the stock originally.

Some stock carvers bring out the lifelikeness in their carvings by staining them before refinishing. To do this use a wood dye like Brownell Water-Soluble Stock Dye. This dye kit contains an assortment of five different dyes and instructions which tell how to mix them to obtain the desired color. They can be used individually or blended. Apply the dye to the carving with a fine brush, and when dry, lightly sand it with 00 steel wool. The high spots on the carving will become lighter as you rub with the steel wool—leaving the low spots darker.

When carving wood for the first time, do not work too long at one sitting. You will become so tired and probably aggravated that you will not look forward to continuing the work. Take your time, working no more than two hours at a time, resting your eyes often.

With a lot of practice, sharp tools, and the will not to give up after two, four, or more mistakes, you will eventually be able to turn out fine work. If you also have some artistic ability, you could develop into one of the few professionals in this country who make a living at carving gunstocks.

Almost every trade or profession is trying to find a quicker way to do things, and the gunsmithing profession is no exception. In recent years, manufacturers and professional shops have been burn-



ing checkering and carvings into gunstocks to simulate hand work. Strive to accomplish the work by hand, but if you want try woodburning. You might be able to find a woodburning kit, which contains a few wooden plates and an electric pencil, at a hobby or craft shop; if not use a small soldering iron, found at any electronic supply house. Lay out the pattern on the stock, then burn the lines into the wood. Clean up and refinish the stock in a usual manner.

## JEWELING

Producing attractive little swirls on metal parts is known by several names, but jewelers, engine turning, and damascening seem to be the most common. In general, jewelers is the process of using a circular abrasive instrument chucked into a revolving head, such as a drill press, to obtain an overlapping pattern of circular spots on bare metal. The work is most often done on the bolts of bolt-action rifles and the breech blocks of other types of actions. Jewelers can also be found on the interior parts of expensive watches and fine shotguns. Besides being ornamental, jewelers of metal is also functional since it provides a built-in wear indicator. In addition, surfaces so conditioned will hold oil better, keeping the surface from rusting or tarnishing so easily. It is a relatively simple operation that adds class to fine guns. The process is done with many different devices such as rubber abrasive rods (pencil erasers will work fine), dowels with abrasive paper glued to the end, or fine wire brushes.

Besides the jewelers rods, you will need some form of drill press to get accurately spaced circles. Inexpensive attachments are available for a 1/4-inch electric hand drill that will suffice if you do not have a drill press available. You will also need some means to hold the piece to be jeweled. For flat objects, a conventional drill vise will do. Rifle bolts are usually held in specially designed fixtures that allow you to obtain equally spaced circles. Make your own from a typewriter by removing the roller and inserting some means of holding the bolt between the two remaining knobs. The space bar on the typewriter will allow for equal spacing along the bolt, while the gear teeth on the knob will provide equal spacing around the bolt. Jewelers fixtures can also be purchased from any of the gunsmithing supply houses.

Place the fixture containing the bolt on a drill press table against a straightedge fence that is clamped to the table, so that the

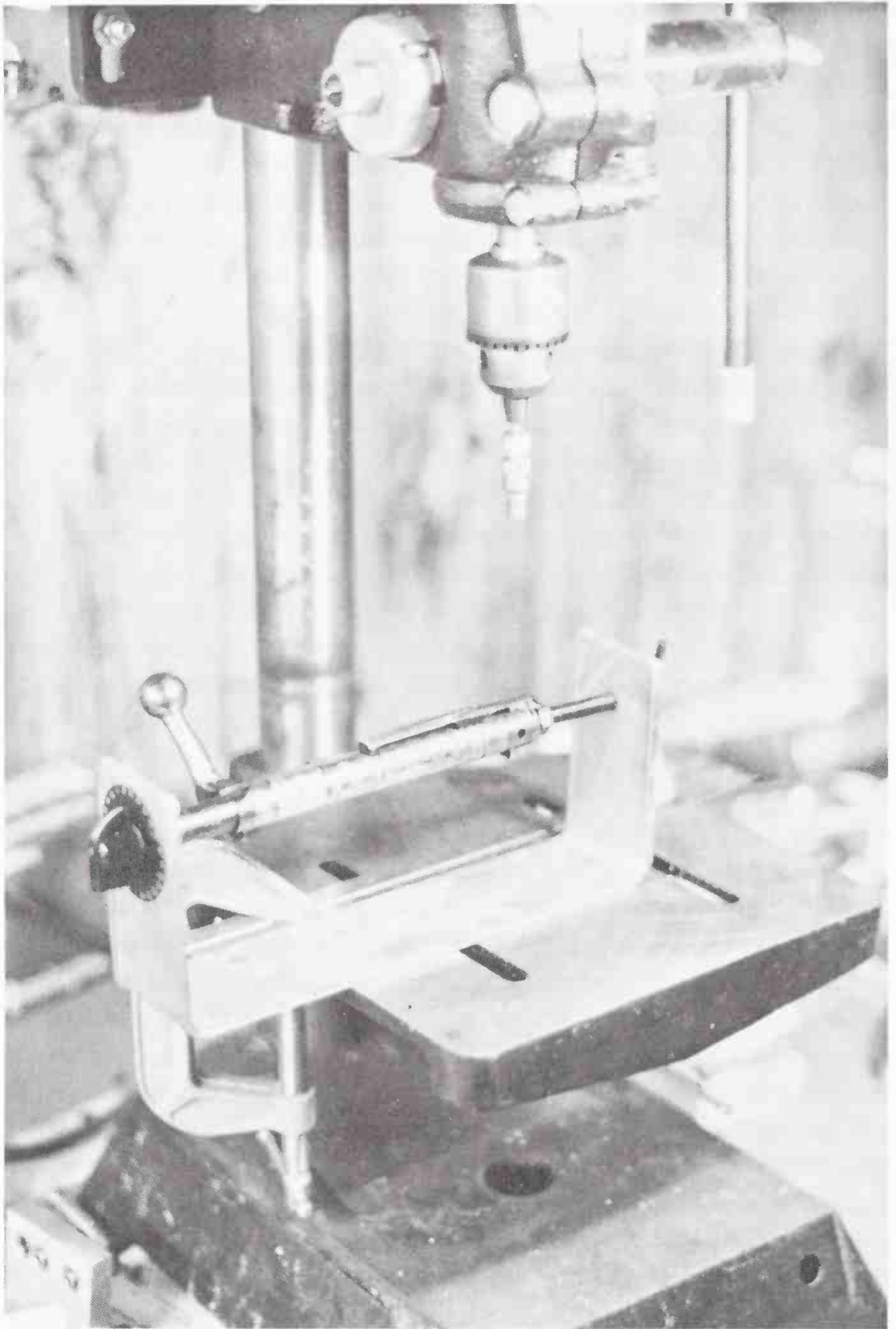


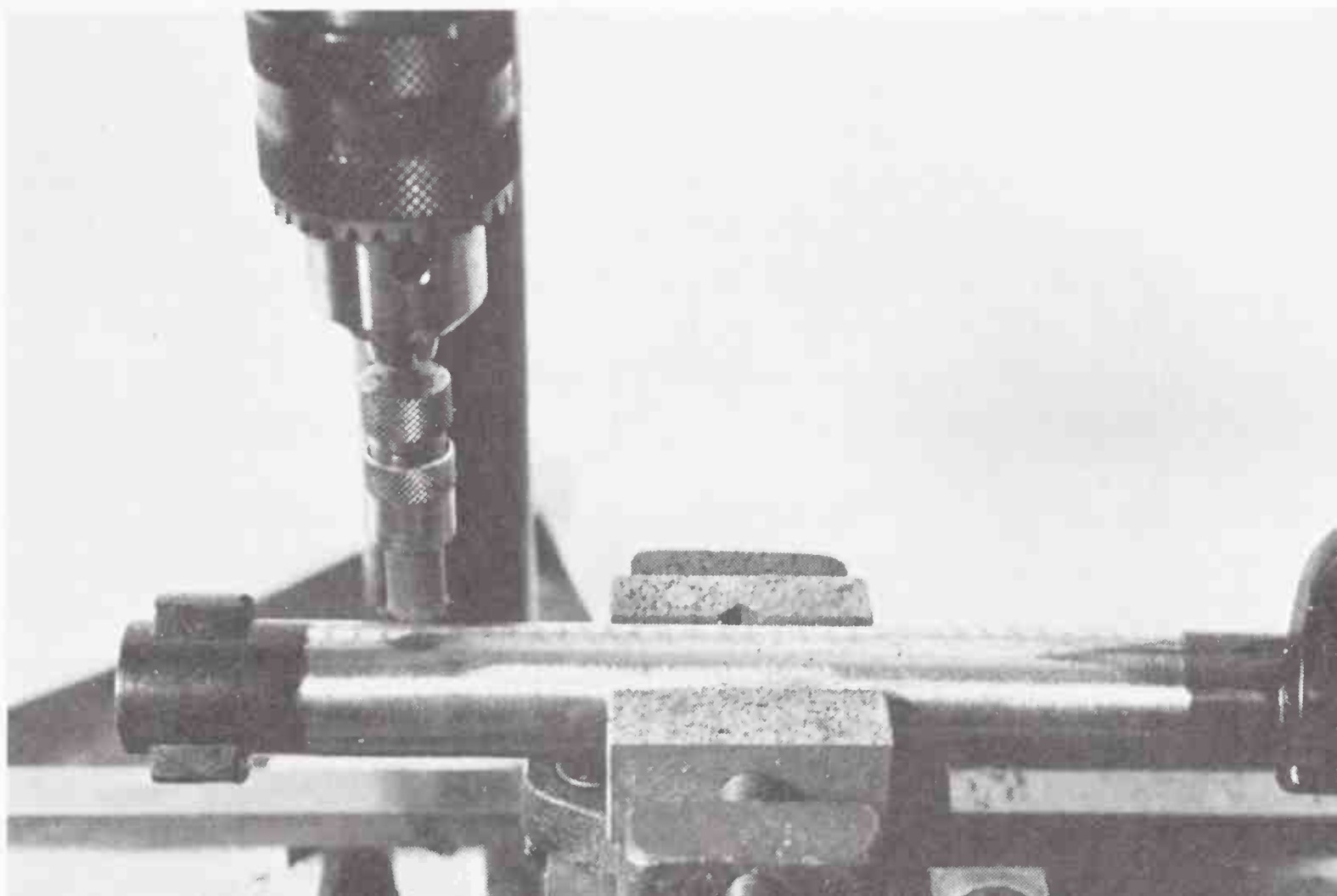
Fig. 11-5. B-Square Jeweling Jig set up on drill press to jewel bolt for Springfield rifle.



Fig. 11-6. Detail of Jeweling pattern.

bolt body is centered under the jeweling tool that is held in the drill chuck. Coat the bolt with abrasive compound; then start the pattern at either end of the bolt, but start all rows of spots from the same end. Run the drill motor at medium speed as you lower it onto the

Fig. 11-7. Remington Model 700 bolt being jeweled on Unimat 3 lathe.





bolt to make an engine-turned ring. Then move the fixture approximately one-half spot diameter and lower the brush again to overlap spots on the surface of the bolt. Continue this for one row of spots. Then rotate the bolt approximately one-half spot diameter and repeat the process. Continue this until the bolt has been fully jeweled in the desired areas.

For other metal objects, use a straightedge as a guide and eyeball the spots as they are turned, overlapping each spot approximately one-half its diameter. On irregular-shaped objects, clamp them on a milling table in a Unimat 3 lathe and use the lathe feeds to move the object the required distance for each engine-turned circle. I do not use a brush abrasive compound on the bolt, as the abrasive rods suit me better. Try different methods to see which one suits you the best.

## **Metal Refinishing**

WHEN POWDER ARMS were first put to practical use around 1350 A.D., it was quickly found that the newly-filed bright metal eventually formed a brown coating when exposed to the elements, caused by ferric oxide or plain old red rust. The gunsmiths or the owners of these arms probably tried to rub off the rust, and while they succeeded in removing the top layer, the metal remained brown underneath. As further attempts were made, the brown stain became even deeper, offering a relatively pleasing appearance. The dull brown coloring of the metal actually was an advantage as the metal no longer spooked game while hunting or alerted the enemy when in battle.

This browning concept caught on, and by the early sixteenth century, nearly every gunsmith had perfected the process of obtaining a rich, deep brown color on all their firearms. The rusting process was hurried by using a salt and water solution on the metal. This



rust was carded off with abrasive cloth, and more solution was applied, this coat carded was off, and so on until the desired finish was obtained.

Around the early part of the nineteenth century, a modified browning process came into use that resulted in a blue-black finish. This modified finish became known as *blueing* in the United States, but the British prefer to continue with the name *browning* even though the finish is black or blue-black.

The earliest blueing solutions consisted of a mixture of nitric acid and hydrochloric acid with steel shavings or iron nails dissolved in them. The process used in applying the solution to the gun metal is generally known as the *slow rust blueing process*.

In general, the slow rust process consists of polishing the metal parts to be blued to the desired lustre and then degreasing the parts by boiling them in a solution of lime and water or lye and water. Without touching the metal parts with bare hands or otherwise letting them become contaminated, the metal is swabbed with the blueing solution in long, even strokes until all parts are covered. The metal is then allowed to stand and rust from six to twenty-four hours. After this the rust is rubbed off with steel wool or a wire brush to reveal a light grey or bluish color underneath.

The surface, still free from oil, is again swabbed with the solution and allowed to rust another day. When this second coat of rust is carded off, the metal beneath is an even darker shade of blue. The process is repeated until the desired color is obtained, taking anywhere from one to two weeks on the average, depending upon the metal and the humidity in the air. The parts then are boiled in water for about fifteen minutes, to stop further rusting action, and oiled. The result is a beautiful, long-wearing metal finish.

The time required to obtain a perfect finish by the slow rusting process forced gunsmiths and manufacturers to seek a faster and easier process. The one developed has been called many names such as *20-minute blue*, *express blue*, but *hot water blueing* is generally the accepted term.

Hot water blueing is based on the fact that steel, when heated, rusts more rapidly than when cold. This is due to a more rapid absorption of the oxygen that forms ferric oxide or red rust. Therefore, new formulas were developed that reacted favorably on metal that was polished, degreased, and then heated in boiling water. Once



boiled for five or ten minutes, the metal parts are lifted from the boiling water where they dry almost immediately due to the heat of the steel. The blueing solution (often heated also) is applied to the hot metal in long even strokes. Rust forms immediately on the metal, but before carding, the parts are once again dunked into the boiling water for another five minutes. The first carding should turn the metal parts a light grey color, and each successive coat should deepen the color until it is a deep, velvety, blue-black color. Depending upon the metal, it may take anywhere from four to twelve coats to obtain the desired finish.

Other blueing methods were developed—Nitre blueing, charcoal blueing—but the major development in gun blueing occurred around the turn of the century when the black oxide process of blueing was patented. This method requires that the parts be polished in the conventional way, but instead of applying the solution to the metal parts, the parts are dunked into a tank of the boiling solution. Once in the tank, the blueing process is essentially a fifteen to thirty minute process of boiling the parts in a strong alkaline solution. The process works exceptionally well on a wide variety of steel and is much more economical for mass production than any other process. Another advantage of this method is that the number of guns that can be blued at one time is limited only by the size of the tank and the heating facility.

During the early part of the twentieth century, an instant or cold blueing process became popular with do-it-yourselfers. The trend is still popular today. The cold blueing solution is a mixture of acids and copper nitrate. The copper nitrate forms a plating on the metal and the acids turn the copper black the instant it touches bare metal that has been degreased.

There are many kits on the market that contain everything necessary to blue guns at home. If care is taken the result can look quite pleasing. The main problem is durability. None of these cold blueing solutions will hold up for any length of time, and eventually the gun will be coated with red rust and no blue.

These cold blueing solutions do have a place, however, in every gun shop—both hobbyist and professional—for touch-up jobs. The cold blueing solutions on the market will most definitely blacken metal, if the metal is properly prepared. Of these solutions, Brownell's Oxpho-Blue seems to be the most durable, but the application

is a little tricky, so it is probably not the best choice for the beginner. Birchwood-Casey's Perma-Blue Paste or G96 Gun Blue Creme are better choices for a first attempt at touch-up gun blueing.

## COLD BLUEING TECHNIQUES

Cold blueing chemicals will not blue case-hardened steel, stainless steel, aluminum, or other nonferrous metals. Case-hardened steel can be readily detected by the mottled colors running through the surface of the steel. If these colors have faded, the metal will have a chrome appearance. Stainless-steel barrels are usually marked like this. Aluminum or other nonferrous metals will not react when touched with a magnet.

The chemicals used in cold blueing solutions are poisonous and should be treated accordingly. Many of the chemicals will affect the skin, so it is recommended that gloves be worn when using them. Skin-tight surgical gloves, available from drug stores or medical suppliers are ideal for cold blueing. They allow free movement and feel, yet give adequate protection from harmful chemicals.



Fig. 12-1. A G96 Complete Gun Blue Kit contains everything needed to blue firearms. The can of Spray Gun De-Greaser does not come with the kit, but is an excellent choice for use with any cold blueing solution.

A good choice for a cold blueing kit is one supplied by Jet-Aer Corp. called G96 Complete Gun Blue Kit. This kit contains everything needed for touch-up and complete reblueing jobs. Or if you have abrasive paper and steel wool, you could purchase only their Gun Blue Creme and G96 Spray Gun De-Greaser.

The area on most firearms that is commonly in need of touch-up blueing is the muzzle on rifle barrels. The muzzle is also a good place to start on a gun because it is not on the same plane as the gun barrel and therefore will be easier to match with the existing blue. Worn spots that are in the same plane with existing blue are much more difficult to match.

The muzzle of a Winchester Model 70 rifle, figure 12-2, will be used to demonstrate the blueing procedure. Note that the muzzle is bright and shiny when compared to the rest of the barrel. This was caused by the muzzle blast from the .270 Weatherby Magnum, the cartridge for which the gun was rechambered. Continued firings caused the blueing to wear off. If allowed to go unchecked, the metal will rust and pit and eventually have to be recrowned.

In this case, spray G96 Gun De-Greaser on the surface to remove the oil and grease from the surface, and then wipe it completely dry with a clean oil-free cloth. Use a piece of abrasive cloth to remove



Fig. 12-2. G96 Spray Gun De-Greaser being used to degrease the muzzle of a Winchester Model 70 rifle prior to touching up the muzzle with cold blue.





Fig. 12-3. A swab is used to apply the gun blue creme to the muzzle and the metal immediately turns black.

rust and pits, and steel wool to shine the muzzle. For best results, make the metal as bright as possible.

Again, spray the surface to be blued with Gun De-Greaser and wipe it completely dry with a clean cloth. At this point, avoid touching the surface with bare hands as fingerprints will leave marks on the surface when the blueing is applied. The surface must be completely free of oil and grease.

Apply the blueing creme with the applicator swabs that come with the kit or with clean gun patches. Work the creme into the metal thoroughly to assure that it penetrates completely. In doing so, an ingredient in the creme polishes the steel to produce a deeper, richer blue finish. However, after the first application, polish the metal surface with fine steel wool so that the fine polishing effect of the Gun Blue Creme will be more effective. After this, no further polishing is necessary.

Hold the muzzle under hot running water to heat the metal. The water will also neutralize the action of the blueing solution. If the metal is hot enough, the water will evaporate almost instantly upon being removed from under the water. Wipe the surface to be sure it is dry.

Reapply the G-96 Gun Blue Creme two or three times until the

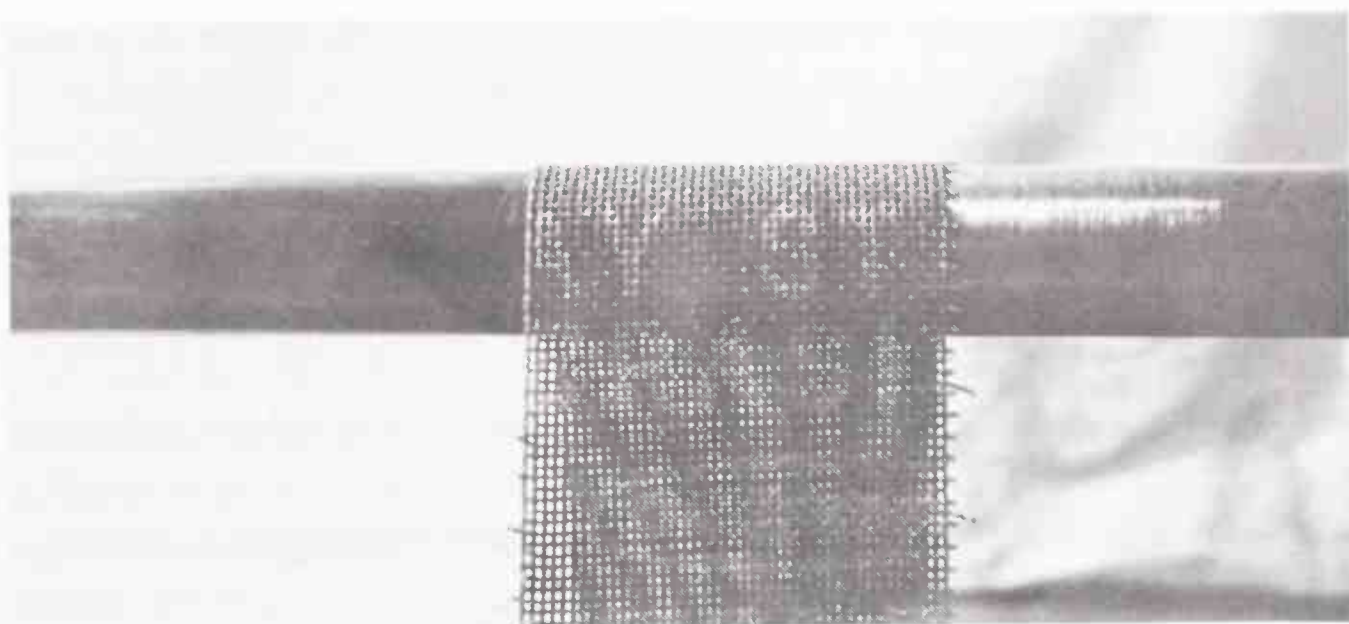


Fig. 12-4. The nonloading, open mesh of Gritcloth lets the removed particles flow right through the silicon carbide charged mesh base rather than packing on the surface and stopping cutting.

desired color is achieved, which blends with the existing blue on the firearm. After each application, neutralize the creme with water, wipe dry, and reapply. Three coats produces the longest-lasting finish.

After the last application of the creme, neutralize the bluing with water and wipe the firearm dry with the G-96 Silicone Gun Cloth. For long-lasting protection, after handling the gun apply G-96 Gun Treatment to remove fingerprints and protect the metal surface against dirt and moisture.

Other parts of the gun can be treated in the same way, except that it is not advisable to hold the gun under the faucet as water can collect in pockets and screw holes of the gun and cause rust to form. Rather, wipe the surface with a wet rag, being careful not to let water drip into metal pockets.

For badly rusted spots, use G-96 Rust Treatment prior to blueing. Using steel wool, remove all loose rust and dirt and other surface accumulations. If the surface is greasy, apply a coat of Gun De-Greaser, then apply a coat of Rust Treatment using a clean cloth. This solution contains acid, so wear gloves during the application to protect your hands. If the rust is extremely heavy, repeat the applications as many times as necessary. After the chemical has turned the rust to a grey powder, remove all traces of this powder with a clean cloth, and once again clean with Gun De-Greaser before applying blueing solution.

Rust Treatment will remove gun blueing along with the rust,

so be careful how you use it. I once accidentally let some of it run down a perfectly good barrel while trying to remove a small spot of rust near the muzzle. All blueing was removed where the liquid ran, and the entire barrel had to be reblued. Dab the swab into the solution and then squeeze out the excess liquid by pressing it against the inside of the bottle rim. To prevent running, apply several thin coats rather than one heavy coat.

As mentioned previously, the cold or instant blueing method is recommended only for touch-up jobs. In a pinch, it will produce a nice-looking, complete blue job if correct procedures are followed—proper polishing, removing all pits and scratches from metal, degreasing, and applying the solution evenly. When completed and oiled, the final result will appear quite similar to a factory hot-caustic blueing job, especially immediately after the job is finished and the metal surfaces are oiled. However, it has been my experience that this appearance does not last as long as some of the other methods.

## **HOT CAUSTIC BLUEING**

The hot caustic blueing method is the one most often used in professional gun shops. It is by far the fastest method to use, and uniform results are obtained with this method more often than with any other. However the method does have its drawbacks for use by the hobbyist with limited facilities. First of all the initial investment for equipment is relatively high for the hobbyist who has only a few guns to blue each year. Then the dangers of using the blueing solution in the home are many. It will ruin floor tile, take enamel off the kitchen stove, eat through leather shoes and woolen clothing, and cause blindness if it splashes in your eyes. It is a method better left to the professional with adequate facilities.

## **SLOW RUSTING BLUEING**

The slow rusting method is within the capabilities of almost any amateur who is willing to put forth the effort, but results can vary so much—depending upon atmospheric conditions—that the method often requires a steam cabinet to insure satisfactory results. Here again, the investment for the cabinet and source of heat to produce steam is a little too much to make the method worthwhile for the hobbyist.



## HOT WATER BLUEING

On the other hand, for a modest investment for the initial setup and from 8 to 12 hours of hard work the home gunsmith can use the hot water blueing method to obtain a rich, velvety, blue-black finish that will surpass any factory job.

The basic technique for blueing firearms by the hot water method was developed in the late 1800s when manufacturers and gun makers started looking for a faster way to get attractive, durable, rust-inhibiting finishes on their firearms. The hot water method enabled the gunsmith to achieve a satisfactory blue-black finish on firearms in only an hour or two which saved a great deal of time over previous methods.

You might have a tough time finding a suitable solution, or even having your own mixed, as most chemical companies no longer stock Sweet Spirits of Nitre, the one ingredient that appears in virtually all hot water blueing formulas. But there are still some commercial solutions available: Belgian Blueing Solution from Herter's Incorporated and Dicropan IM Blueing Solution from Brownell can both be used in the hot water method of blueing, although the Dicropan IM solution is really a cold, instant bluer.

Roy Dunlap reports that he has used the traditional blueing formulas leaving out the Spirits of Nitre with the same results; it just takes longer for the solution to bite the metal.

To mix your own, combine the following ingredients dry in a clean, wide-mouthed, glass jar:

- 1/4 ounce Potassium Nitrate
- 1/4 ounce Sodium Nitrate
- 1/2 ounce Bichloride Mercury
- 1/2 ounce Potassium Chlorate
- 3/4 ounce 3% Nitric Acid in Grain Alcohol solution

Then heat 10 ounces of distilled water until warm (about 120 degrees Fahrenheit) and pour it slowly into the container holding the mixed dry chemicals, stirring with a glass rod continually until almost cool. Pour the entire solution into a dark brown, glass or plastic bottle with a tight plastic cap. Keep the mixed solution in a dark, cool place, the same as you would to store photography chemicals. Before each use, shake the bottle to mix the ingredients.

### **Basic Equipment**

Only one tank is required for this method of blueing, but two

separate tanks will speed up the process a little. Put the degreasing solution in one tank and boiling water, to bring the parts to the required temperature to accept the blueing solution, in the other. A third tank will help if you do not have a supply of running water close by.

The source of heat could be the kitchen stove, but to keep peace at home, you might be better off using a portable camp stove. Of course, if you are planning to do blueing professionally, the three-tank blueing unit with pipe burners offered by Heatbath Corp. is the ultimate setup.

Besides blueing tanks and a source of heat, the equipment needed for the hot water blueing process is as follows:

*Alkali Cleaner* An alkali cleaner such as Dicron-Clean No. 909 is used to remove all grease, dirt, and buffing compound. It is added to the water and brought to a temperature of 180 to 200 degrees Fahrenheit before submerging the parts to be cleaned.

*Blueing Solution* Use any of the commercial varieties or a solution mixed from the formula mentioned in this chapter.

*Glass Jar* Used to hold the blueing solution for heating in the blueing tank usually suspended by an iron wire in one corner of the hot-water tank.

*Swabs* Used to apply the blueing solution to the metal parts. You can make your own by slitting small dowels at one end to hold cotton cloth or cotton balls. Shop swabs sold by Brownell have large wire-ring handles for ease of operation and are highly recommended for this type of blueing.

*Steel Wool* Used for general carding (removing rust) of metal surfaces. Most steel wool contains a coat of oil when it comes from the factory to prevent rusting. Make sure you remove this oil, by burning or with a degreaser, before using it on the gun parts.

*Stainless-Steel Brush* Used for carding rust from hard-to-get-at places on guns or gun parts. Make sure the stainless-steel wire is free from grease and oil before using.

*Carding Wheel* A soft wire wheel with about .005-inch wire is sometimes preferred for carding the rust during the hot water method of blueing to give the required soft wiping action. It should be run at a speed of about 600 rpm for best results. A 1/4-inch drill motor clamped to the workbench is about right for this process. Touch the metal very lightly to the wheel or you may take off some of the blue in the process.

*Dremel Moto-Tool* (optional) The Dremel Moto-Tool using wire brushes is sometimes used for carding small recesses on the gun. Three types of brushes are currently available.

*Rubber Gloves* Some of the older gunsmithing books recommend wearing white cotton gloves that have been thoroughly washed to remove all oils for this blueing process. The purpose is to prevent getting any body oils from the hands, which will ruin the blueing, onto the gun parts. Cotton gloves are okay for all steps except carding, because they quickly become soiled in this process. Rubber gloves are better since clean rubber gloves not only protect the gun surface, they also offer better protection to your hands from the blueing chemicals and the hot gun parts after they are removed from the water. Should rubber gloves become soiled during the carding process, merely dip them into the hot cleaning solution for a few seconds.

## **Polishing**

Before the blueing solution can be applied to the metal, the surface of the metal must be stripped of its old finish and polished. The quality of this polishing job will determine the quality of the final finish. A poor polishing job will result in a poor blueing job; those pits and scratches in the metal before blueing will show up even more after the gun is blued.

Professional shops often utilize power buffers for polishing production blueing jobs, but most hobbyists will have to do the polishing by hand. So much the better, only with hand polishing can all contours, lettering, markings, and square edges be insured against preservation. Roy Dunlap points out in *Gunsmithing* (Stackpole Books) that a hand-polished gun looks better than a power-polished one, since corners and angles can be maintained with no loss of outline.



The surprising fact is that an excellent final finish can be obtained on metal polished by hand, while metal polished by power will not turn out as well. But be prepared for a lot of hard work. It will take from six to eight hours to properly hand polish a bolt-action rifle; longer for a pump, autoloader, or double-barreled shotgun.

The first step is to disassemble the gun completely, down to the last screw and drift pin. Wipe the parts clean and examine each one to check for wear and to insure that no aluminum alloy parts are present. This can easily be determined by using a small magnet. If the magnet does not react, the part is nonferrous; that is, aluminum, brass, or similar alloy. These parts, which consist of springs and other small elements not visible in an assembled gun, should be set aside with others not to be blued.

After all the pieces to be blued are in one pile, thoroughly clean each one with a solvent such as acetone AWA 1-1-1, the safer substitute for carbon tetrachloride. The parts are now ready for polishing after obtaining the following items.

A 10-inch mill bastard file and file card are needed to remove rust pits, nicks, or scratches that are too deep for the abrasive paper to remove. Otherwise, these two items can be eliminated. Purchase three sheets each of the following grits of open-coat, aluminum oxide abrasive paper: 80 grit; 150 grit; 240 grit; 320 grit.

To get a master polishing job, also obtain three sheets each of 400-grit and 500-grit, silicon, wet-dry paper for the final polishing.

In recent years, many professionals who do hand polishing on firearms have begun using a relatively new type of abrasive paper called Gritcloth. This abrasive cloth will cut the time required to hand polish a gun and claims to do it better than any other hand method known. Gritcloth is composed of thousands of particles of abrasive which keep cutting up to fifteen times longer than any other abrasive cloth. The nonloading open mesh allows the removed particles to flow right through the silicon-carbide-charged mesh base of Gritcloth rather than packing on the surface and impeding cutting. Because of the open mesh, it cuts many times faster than conventional abrasive paper.

The cost of Gritcloth is higher than other types of abrasive cloth, but due to the cloth's exceptionally long life, it is probably less expensive in the long run. Grits available are #100, #150, #240, #400, and #600.

With all the materials at hand, start with the barrel or the barreled action and clamp this assembly in a padded vise. Take care, however, not to "clamp down" too hard and damage the gun parts. Clamp the part so that the most surface is exposed, but yet tight enough to hold.

Use the 10-inch mill bastard file to smooth out deep rust pits, nicks, scratches, and all metal surfaces.

With the file in the left hand and the tip in the right hand, position the file at the most distant point on the barrel and draw the file smoothly toward you. Use enough pressure to smooth the metal surface without scratching it. The amount of pressure you use on the file is very important; too little will scratch the metal, while too much will clog the file and cause scratches. At the end of each stroke, lift the file from the metal and sort of arc it back to its starting position; then again use pressure and draw the file toward you. Repeat this procedure until all pits and scratches are removed.

The barrel is now ready for cross-polishing to remove the many flats that will be left after draw filing. With a pair of scissors or a bench knife, cut a strip of 80-grit abrasive paper about 1 1/2-inches wide, cut the long way, and polish (fig. 12-5). Go at the metal as

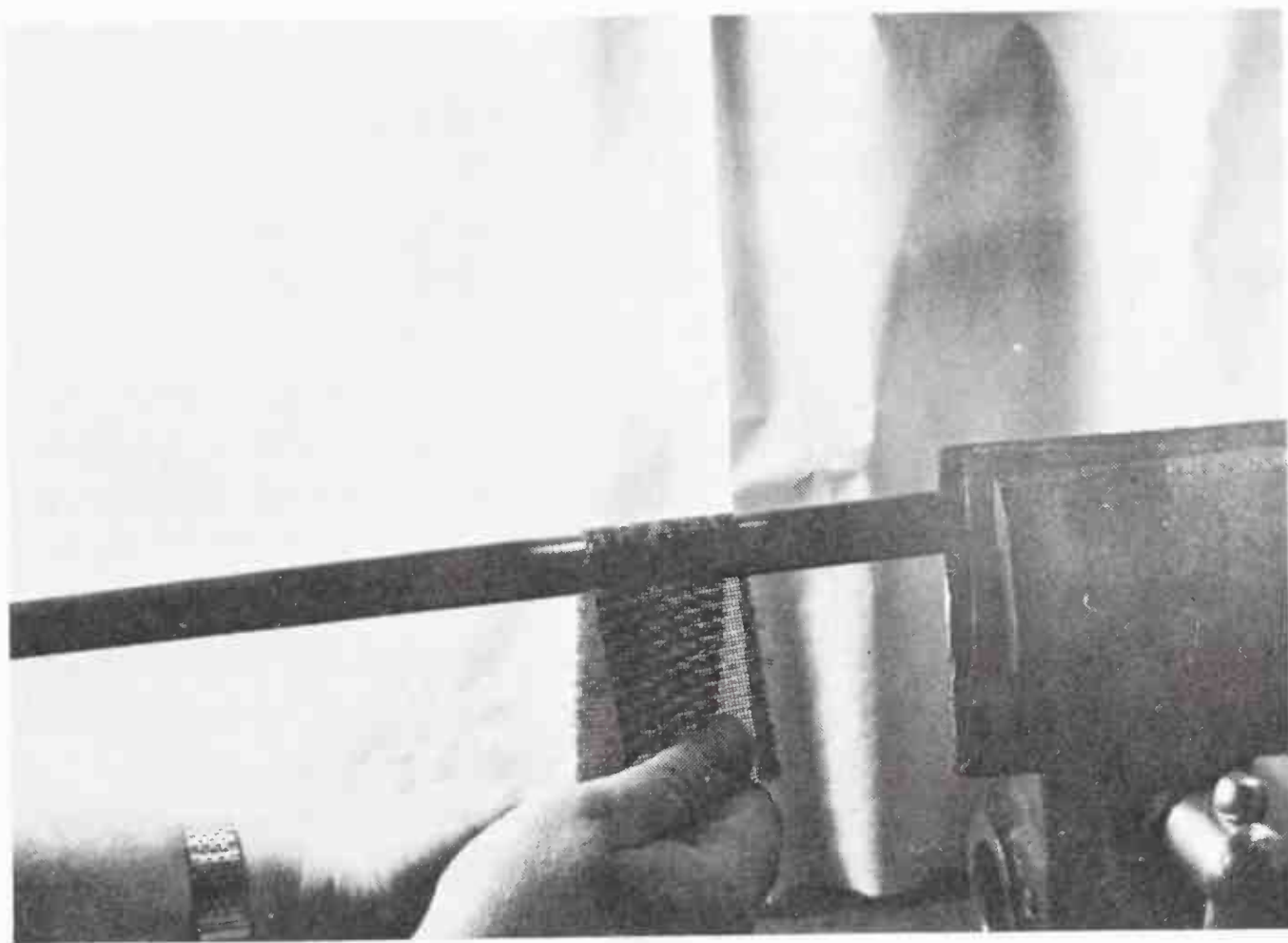


Fig. 12-5. Cross-polishing is done much the same way as shoe polishing.

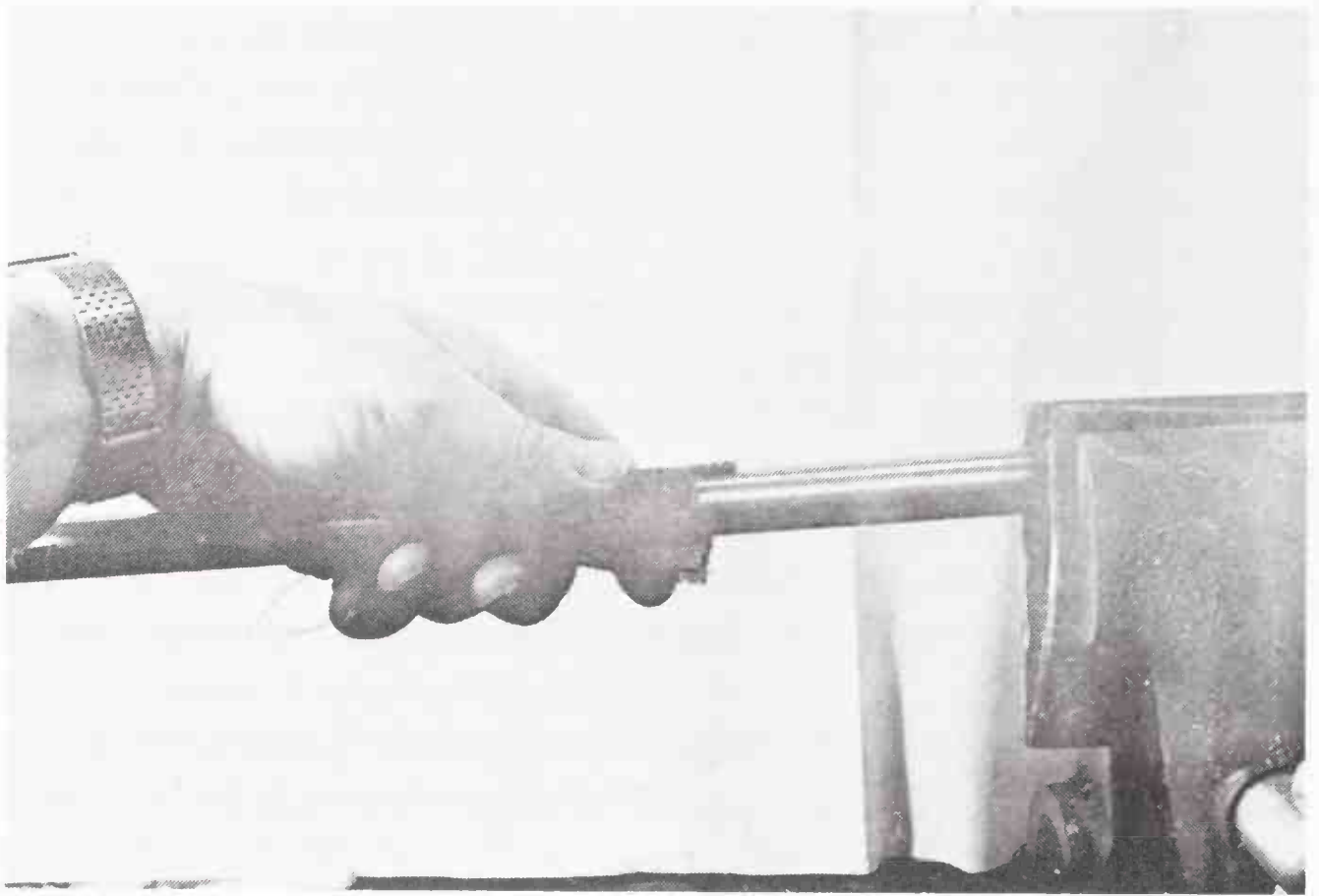


Fig. 12-6. Draw polishing is done after cross-polishing. This technique should be continued until all cross-polishing marks from the previous operation are removed.

though you were shining a pair of shoes. The first few strokes will reveal the flats left by the draw filing. Continue this operation over the entire length of the barrel with the 80-grit paper until all of the flats disappear and the barrel looks like it has just been turned down in a metal-turning lathe. You might have to use several pieces of the abrasive paper to achieve this polished condition.

Cut a 1 ½-inch strip of the 150-grit paper and fold it as shown in Figure 12-7. With the open edges in the direction of the axis of the bore, start polishing the barrel lengthwise. Continue polishing in this manner until all cross-polishing marks from the previous operation are removed.

These procedures should be repeated alternately, using progressively finer grits (higher numbers) until the final draw is completed with the 500-grit silicon set-dry paper. To review, the technique is: 80 grit—cross-polish; 150 grit—draw polish; 240 grit—cross-polish; 320 grit—draw polish; 400 grit—cross-polish; 500 grit—draw polish. With the 400- and 500-grit papers, apply a drop of oil to the paper before using. Make sure that all polishing marks are removed before proceeding to the next finer grade of paper.



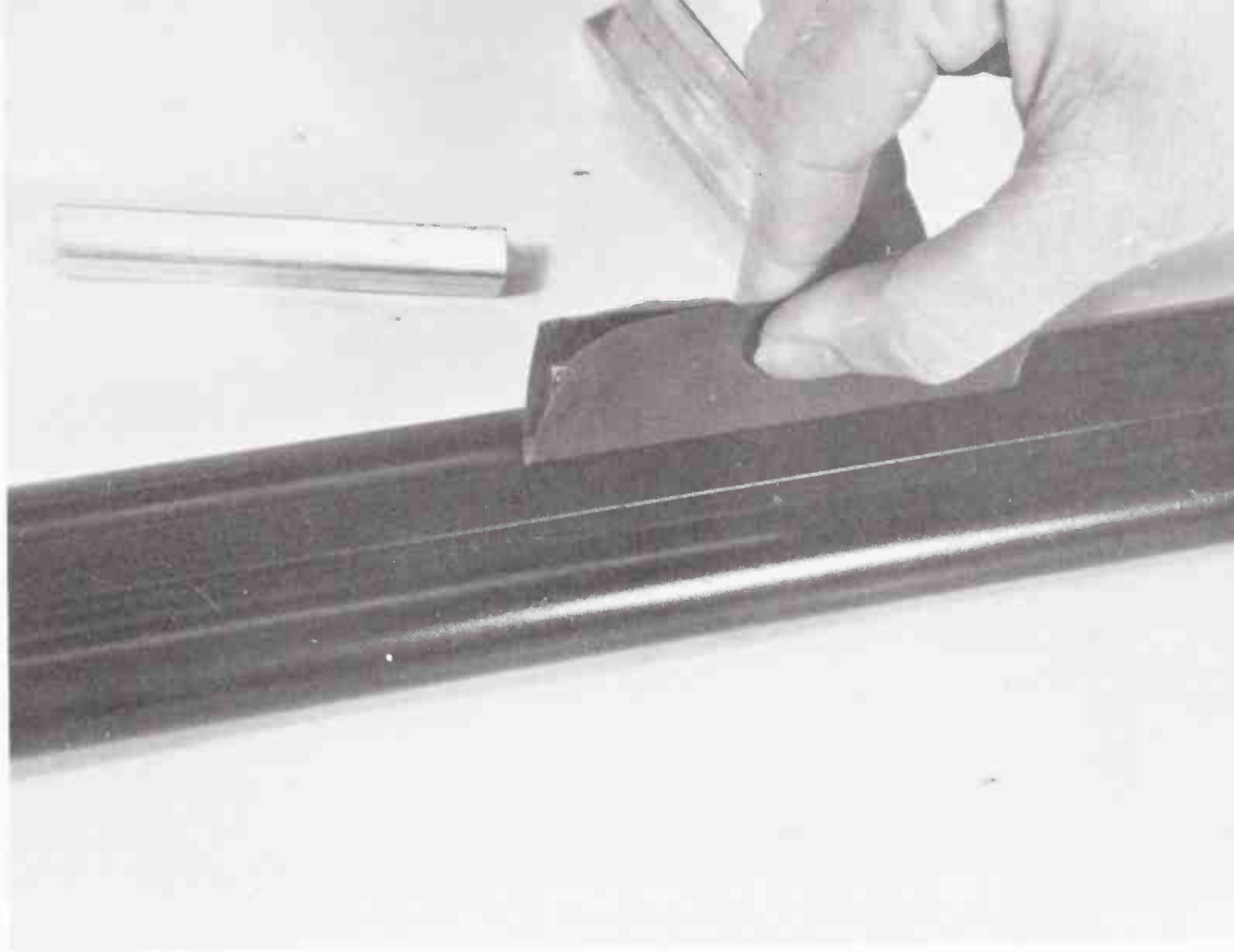


Fig. 12-7. Special sanding blocks are available for hard-to-reach areas.

Once the barrel has been polished, its position in the vise should be reversed. Then polish the receiver in a similar manner, but make certain that the newly polished areas are well protected from the vise jaws. Heavy leather padding offers good protection. Then continue with the trigger guard, trigger, floor plate, and other parts. Most of the smaller parts, however, due to their shape, will be most adaptable to cross-polishing all the way, and not lengthwise polishing as was done on the barrel. Just be sure that all polishing marks from the previous grit size are completely removed before using a finer grit size. Protect the newly polished surfaces from rusting with a light coat of oil until you are ready to apply the blueing solution.

Screw heads are best polished by securing them in a screw holder (fig. 12-8) and using a power buffing wheel with different size grits for polishing. If a buffing wheel is not available, insert the screw in the chuck of a  $\frac{1}{4}$ -inch electric drill held in a vise and, while the screw is rotating, run a file over the screw head. Complete the polishing this way with the various grit sizes of abrasive paper. The gun is now ready for blueing.

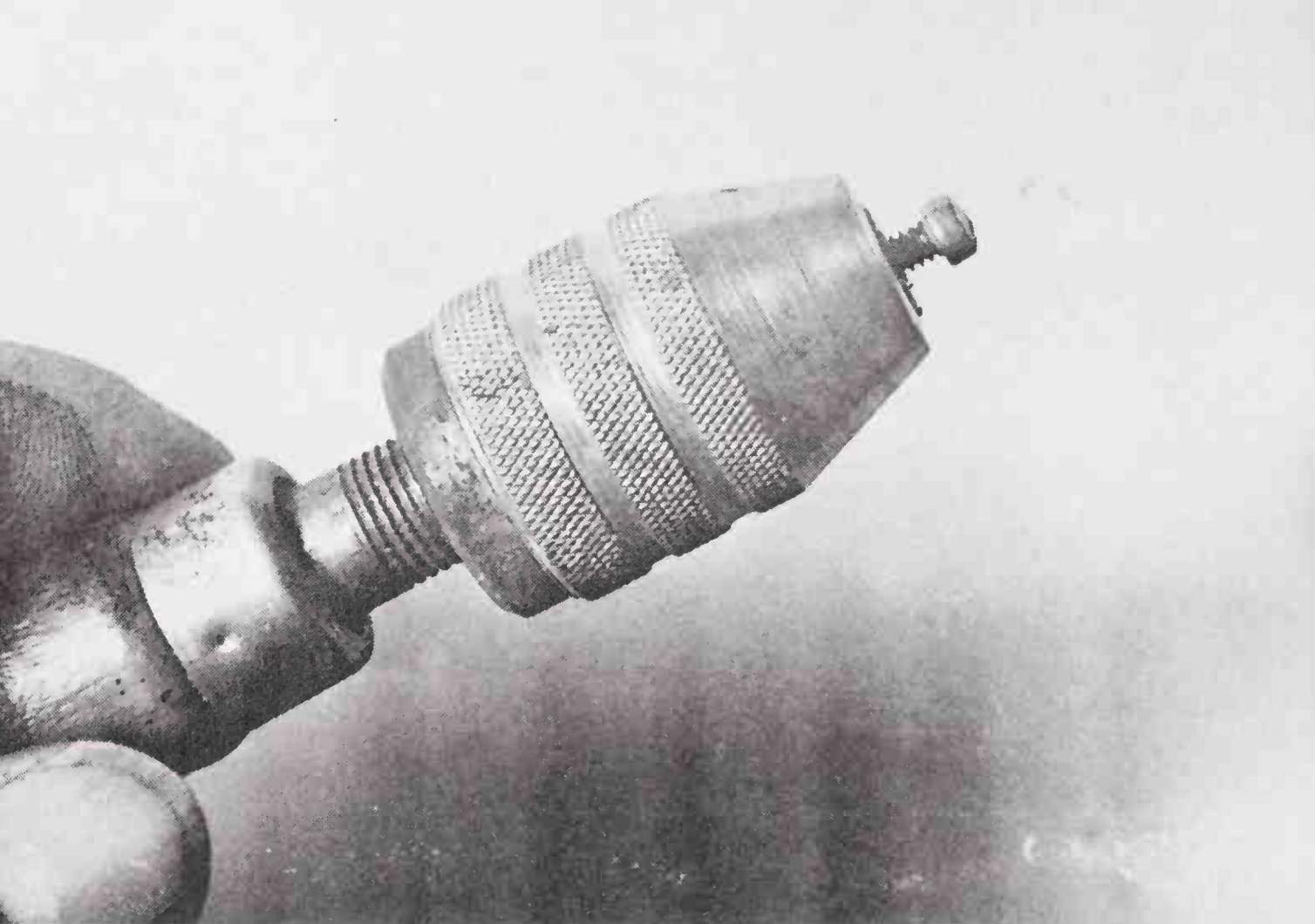


Fig. 12-8. Screw heads are best polished by securing them in a screw holder.

### *The Blueing Process*

For getting into hard-to-reach places, like beside the rib on a shotgun barrel, the work can be made easier by using sanding blocks specially shaped for the area. There are several types, including block, contoured, and knife-edge—the latter being specially suited for along barrel ribs.

Many actions, like the receiver of Winchester Model 12 shotguns, should be sanded with a perfectly flat backing block to insure that the corners and edges remain square and to prevent funneling of screw holes. Rounding of the corners on such a firearm will lower its value considerably.

Once all the parts are polished, begin heating up your tanks. If there is going to be a delay between the polishing and the blueing, certain precautions must be taken. A freshly polished gun is a prime target for surface rust. A break of a few days, or even a few hours under some conditions, between final polishing and blueing can result in fine “silver” spots showing up on the gun after it has been blued. These are caused by microscopic rust spots that develop while the gun is being held following polishing. High-powered rust preventatives should not be used during this storage period because

they are difficult to remove and if they are not completely cleaned off prior to blueing, they will result in a botched-up blueing job.

Brownell's HOLD is the modern answer to in-shop storage of guns and parts following polishing, grinding, or milling. It chemically engages free oxygen and neutralizes all acidic impurities, including fingerprint acids.) No petroleum additives are included so oily surfaces are not a problem. Therefore, polished, HOLD-treated parts may be put directly into the cleaning tank with no change in the regular hot water blueing tank technique.

Once the parts have been polished, pour enough water into one of the tanks to completely cover the gun and all its parts. Add an appropriate amount of cleaning solution—Dicro-Clean No. 909 or 1 tablespoon of household lye to 2 ½ gallons of *soft* water. (If you do not have rainwater, use distilled water which can be purchased at any drug store.) Then suspend the gun and gun parts by black iron stovepipe wires, making sure that all parts are at least 1 inch away from the bottom and sides of the tank and sides. Otherwise hot spots and blotchy blueing will result. Small parts can be individually suspended by black iron wires or else placed in a black iron or stainless-steel basket which is then suspended in the tank. Let the parts “cook” in the cleaning solution for about 15 minutes.

While the parts are being cleaned in the alkali cleaner, heat a tank of clean rainwater or distilled water. Suspend the clean jar containing the blueing solution in one corner of the tank, so that part of the jar is underwater. This will heat the blueing solution. Be careful not to let any of the water in the blueing tank splash into the jar and weaken or contaminate the blueing solution.

After the cleaning period is completed, remove the parts from the cleaning tank and quickly transfer them to the rinse tank, containing clean, cold rainwater or distilled water, and then immediately into the hot water tank. The water must be kept at a hard, rolling, bubbling boil from here on out to obtain the best results.

Let the parts boil for a full 15 minutes the first time to insure an even heat throughout, and then lift them out of the water using the wires as handles. The parts should dry immediately if they are hot enough. If not, put them back into the boiling water for a slightly longer period. Do not worry about getting the parts too hot; the only danger is not getting them hot enough. When the parts are hot enough, remove them one at a time. Set the first part on clean “V”-



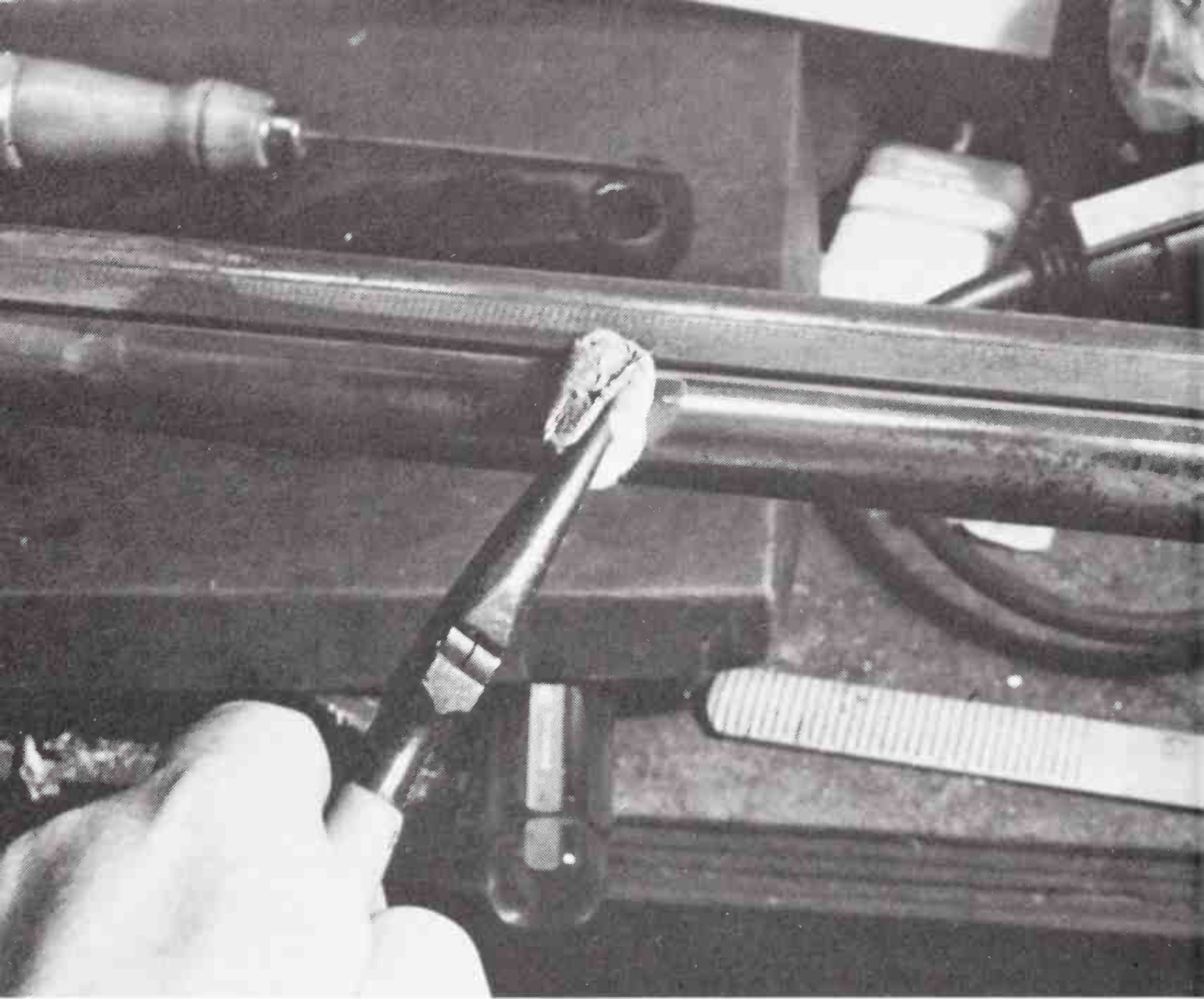


Fig. 12-9. Apply the blueing solution in long, even strokes.

blocks or clean paper, or suspend it in midair with wire. Then, as quickly as possible, before the part cools too much, dampen a swab with hot blueing solution by dipping it into the suspended jar. Do not "load" the swab, just dampen it. Apply the solution in long even strokes. When all metal surfaces are covered with the solution, hang the part up to dry. The parts should be so hot that the solution dries immediately, leaving a light grayish-brown coat on the parts. Remove another part from the boiling water and give it an even coat of the solution. Continue this until all parts have been coated with the hot blueing solution, and all parts are drying.

After all parts have been coated, return them to the boiling water for about five minutes. Again remove them one part at a time and swab more of the solution onto the hot metal surfaces. Return the parts to the hot water tank after the solution has dried.

Following the second application, you will see a darker coat of gray, flecked with rust, forming on the metal. Now, before returning

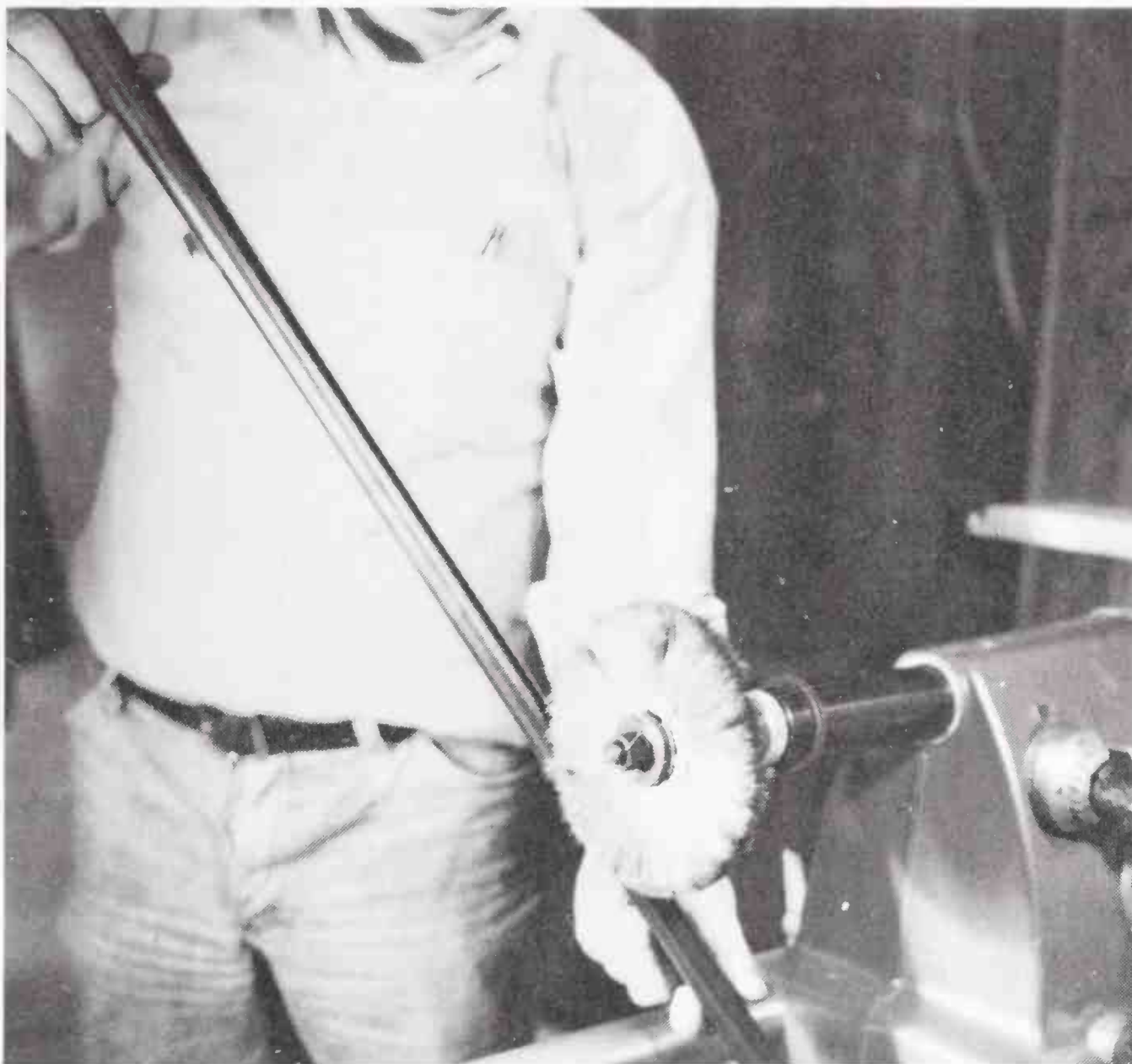


Fig. 12-10. A wire wheel can help speed up the process of carding parts when using the hot water method of blueing.

the parts to the hot water tank, rub them with 00 steel wool to remove the rust particles. Do not rub the parts too vigorously as this may remove the thin coat of light grayish-brown blue.

After carding all parts, return them to the boiling water for another five or six minutes and repeat the swabbing, drying, and boiling steps. As you put on more coats of the bluer, the brown or grayish-brown blue gradually will turn to a rich velvety blue black. This may require as few as four coats or as many as ten or twelve or more, depending on the type of steel being blued.

Keep repeating these steps until the gun parts reach the desired shade of blue-black.

After the last coat of bluer has dried on the parts and has been removed with steel wool, wire wheel, and/or stainless-steel brush (for tight places), place the parts in the boiling water once more and



boil them thoroughly for about fifteen minutes to stop all rusting. The parts will dry almost immediately upon being lifted from the water. When cool, oil all parts or boil them in a water-displacing oil. Remember, heat only oil specifically designed for this purpose; most oils will ignite and cause damage if heated.



## **Common Malfunctions**

FIREARMS OF RECENT manufacture that have been taken care of will normally last a lifetime. However, any gun that is used frequently will eventually develop a malfunction, requiring the repair or replacement of a part before it will again operate properly. For example, firing pins and trigger springs, due to continuous compression, will eventually weaken and either break or become too weak to function properly; these will then have to be replaced. Bearing parts will become worn or develop burrs and will either have to be reworked or replaced. The finishes on both wood and metal parts will become worn and will need refinishing. These are just a few.

Diagnosing malfunctions in firearms may seem like a difficult task to the beginner, but all professional gunsmiths will tell you that after some experience, trouble-shooting becomes second nature. Just remember, before a problem can be corrected, you have got to

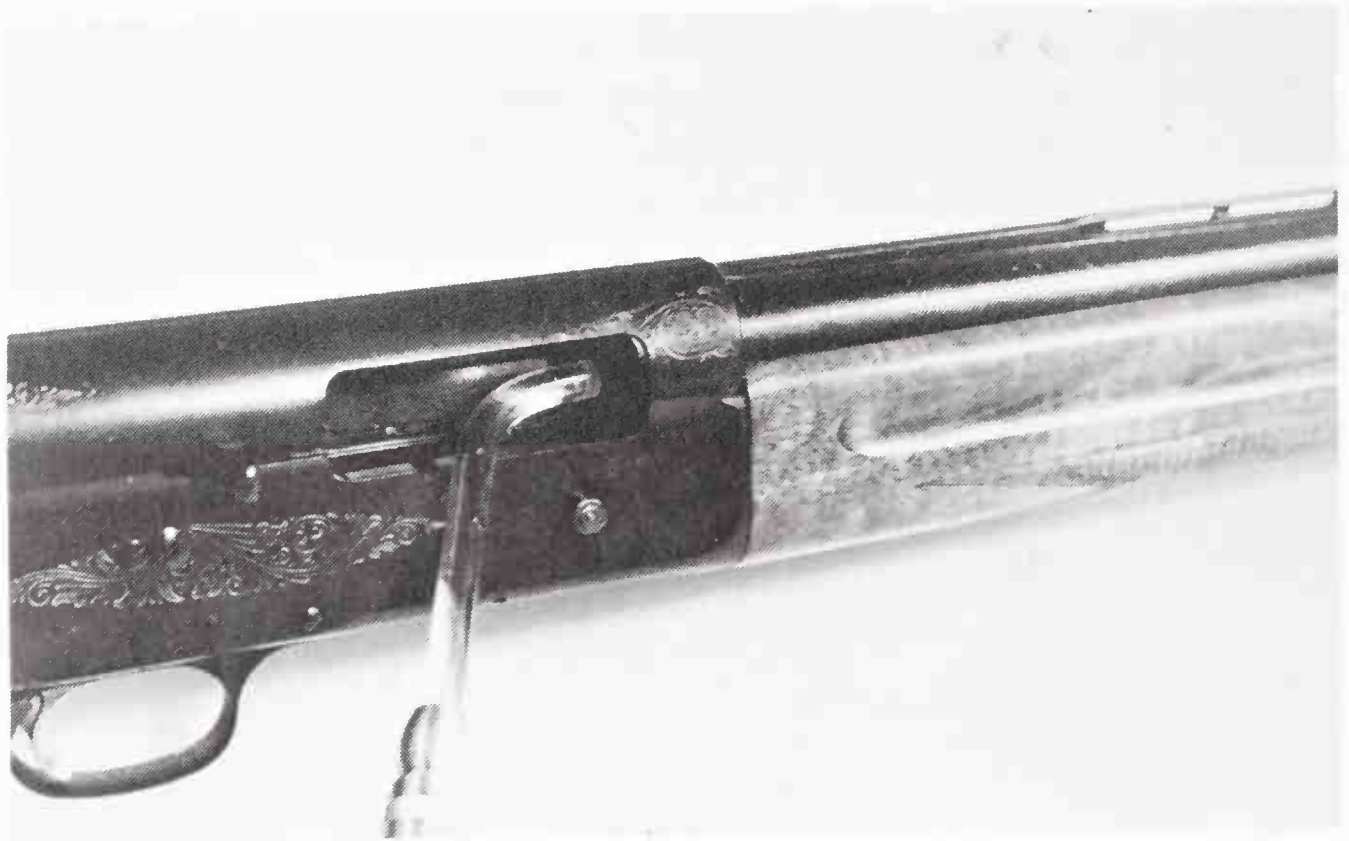


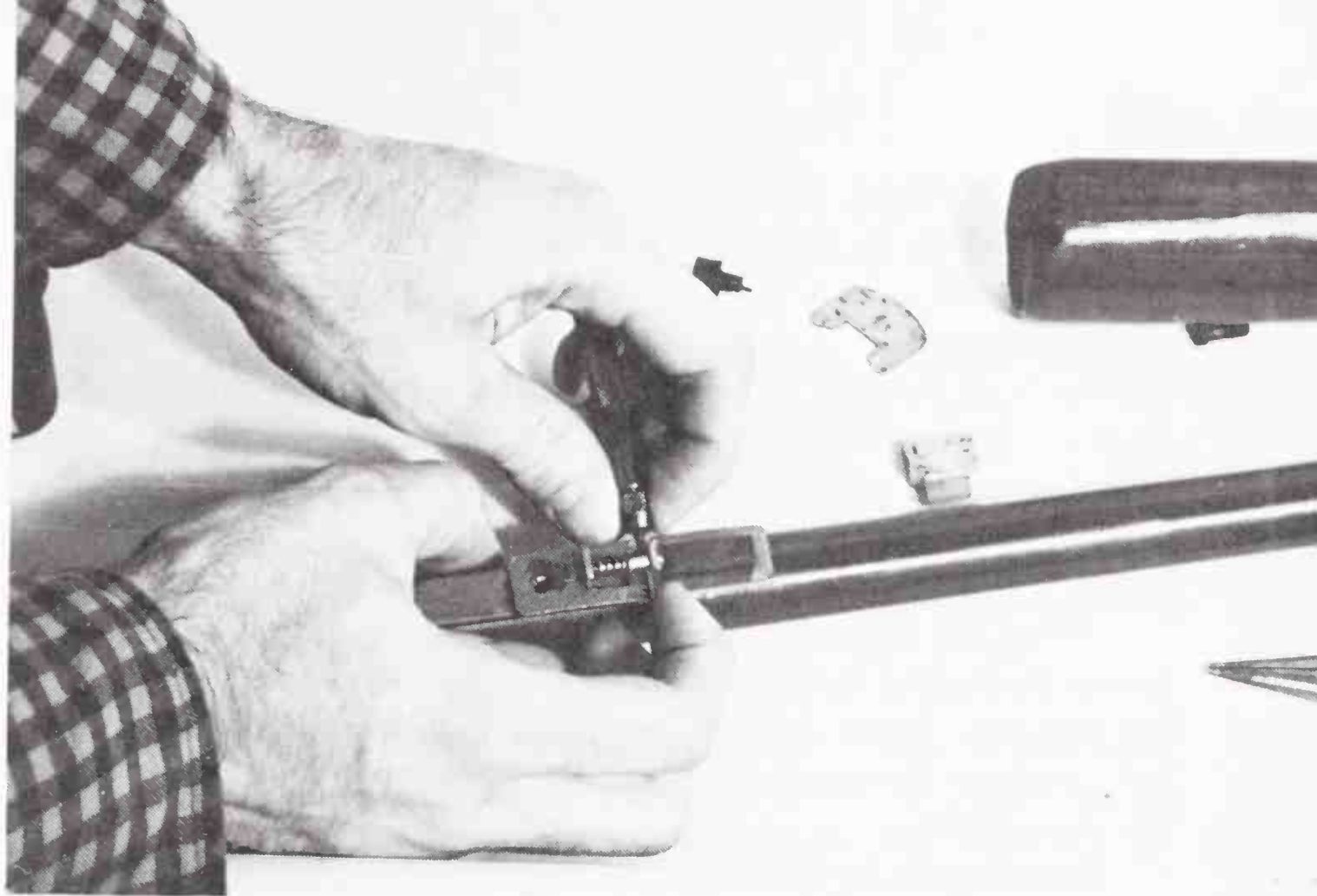
Fig. 13-1 . The first step in troubleshooting a firearm should be visual inspection using a bore light.

find the cause of the problem and then come up with a definite plan of action for repair.

A careful visual inspection along with operating the gun's action will often reveal a common malfunction and enable the gunsmith to solve the problem in quick order. Other problems, however, will require that the gun be disassembled, thoroughly cleaned, and a careful visual inspection of each part be made to determine the problem. But before you start tearing a firearm apart, first use a good bore light and carefully examine all the areas you can reach without disassembling the firearm. For example, check the chamber for rough spots and for possible deformation of the extractor slots cut in the barrel; check the firing pin for wear or breaks, especially notice if any grime or other foreign matter is in the working mechanism that might prevent the gun from functioning properly (this is the main cause of many feeding problems). In fact, a thorough cleaning will often correct a problem without further action.

Firearm manufacturers often furnish troubleshooting charts as well as disassembly instructions with the guns they sell. There are also several books on the market that give hints how to troubleshoot firearms. While all of this material is useful, it can never be complete, as there are just too many variations and solutions for a given





**Fig. 13-2.** If no immediate defects are apparent from the initial inspection, disassemble the gun for a more thorough examination.

problem. The best procedure is to learn how all types of firearms operate, including the function of individual parts. Then when one of these parts or group of parts is not performing its job, you'll know to start looking in that direction.

One of the best ways to learn operating principles of firearms is to disassemble and assemble actions of all types. Don't start out on a valuable firearm as a beginner can damage a firearm beyond repair just by disassembling it if he doesn't know what he's doing. Rather, obtain an old rusted single-barrel, break open shotgun for example that is ready for the junk pile and start on this. It is probably in need of repair anyway.

Start by moving the lever to the right (if you happen to have this type). You will notice that the barrel unlocks from the receiver. But why? There's no magic involved. When the lever is moved, something mechanical must move to unlock the barrel from the receiver. While the barrel is open, look down into the receiver and move the top lever again. You will notice a metal block move either back and forth, or up and down. This is called the locking bolt and is kept in a forward or up position by a locking bolt spring. When



the barrel is closed, the locking bolt locks into the barrel hump and is kept in place by the locking bolt spring.

If you get a bore light and shine it into the receiver (with the barrel open) you will probably notice that a rod is connected to the locking bolt, usually entering from the side. This connecting rod connects the locking bolt with the top lever yoke so that when you push the top lever to the right, the rod pulls the locking bolt to the rear, compressing the locking bolt spring and in turn, unlocking the barrel.

When you push the top lever to the right, you should feel some resistance caused by the locking bolt spring. If you feel no resistance, the first assumption is that the spring is broken. If the barrel does not unlock at the same time, the connecting rod is either broken or has come loose.

Continue your inspection of the shotgun until you know the purpose of each part and also its relationship to the other parts. When you have completed this inspection, you should be in good shape to diagnose any problem that might develop in this type of shotgun. You should then examine as many different guns as you can get your hands on and try to determine how each functions. You do not necessarily have to disassemble them; many of the operating parts can be seen without doing so.

The above examples are just a few of the many problems that can occur in firearms. Knowing how various types operate will help tremendously in solving problems that may occur.

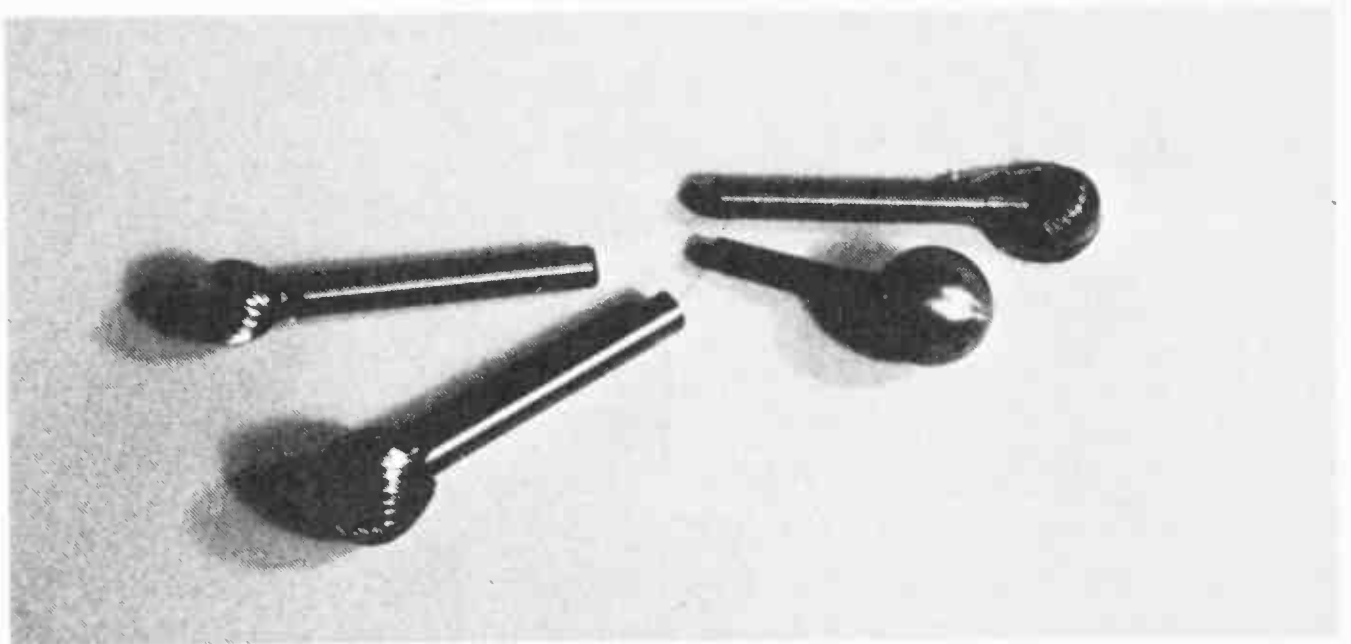


Fig. 13-3. Muzzle-crowning balls are useful for repairing damaged muzzles on rifles or pistol barrels.

## DAMAGED MUZZLES

Every so often you will find a rifle that is not accurate. There could be several reasons for this problem: worn rifling or poor wood-to-metal fit, for instance. But before looking at all these possible causes, first look at the muzzle. Chances are the rifling at the muzzle has become damaged from striking it against a hard object—*burring the muzzle*.

If such a problem exists, your best bet is to rush the gun to your nearest gunsmith and have him recrown the barrel on his metal-turning lathe, cutting the barrel back about 1/8". However, you might want to try crowning the rifle yourself. Just be sure not to take off too much metal so that your local professional will have some stock to work with in case you botch the job. Complete instructions for barrel crowning are given in a later chapter.

## LEVER-ACTION MALFUNCTIONS

The most common problem that occurs with Marlin and Winchester rifles, both centerfire and rim fire, is looseness caused by

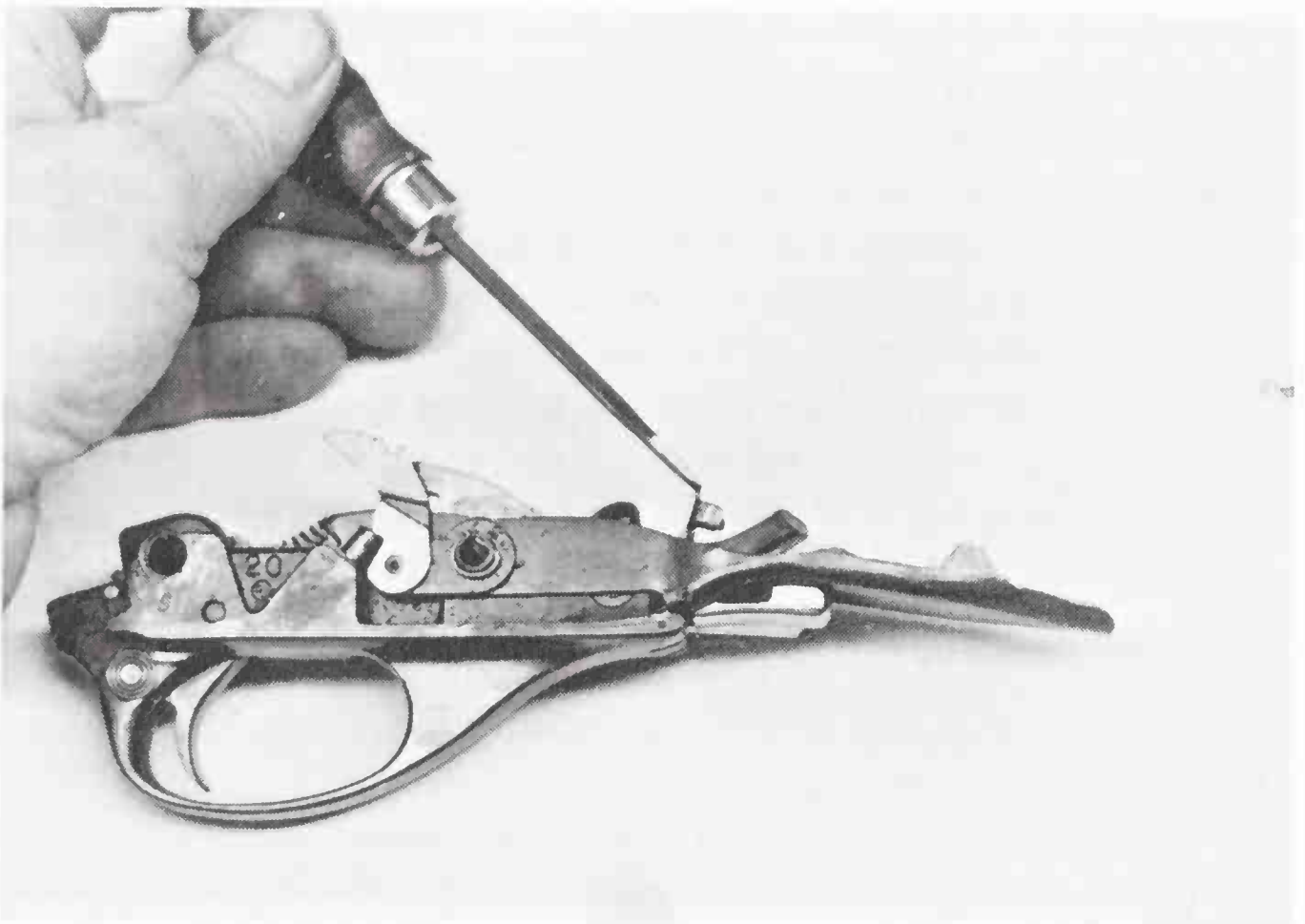


Fig. 13-4. The carrier latch on the Remington Model 1100 is activated by the head of the shell as it leaves the magazine. A weak magazine spring will cause feeding problems.

wear of moving parts or continual shooting of high-pressure cartridges. Original round holes in parts will become egg-shaped, mortises in the receiver will become worn, and metal will be shed from mating surfaces. Any of these can lead to malfunctions and an unsafe firearm.

Feeding problems are often encountered that are caused by dented, dirty, or corroded magazine tubes and/or weak magazine springs. Recesses in the receivers of lever-action rifles are prone to collect all sorts of debris and foreign matter which, when combined with gun oil and grease, cake and gum up the action, causing feeding, extraction, and ejection problems.

The third most common problem in the older lever-actions is excessive head space. These rifles lock up at the rear of the sliding breech bolt. After much firing, stretching will occur which causes excessive head space.

## **BOLT-ACTION RIFLES**

Bolt-action rifles seldom give trouble, even when misused, but occasionally a problem will develop that requires the attention of a gunsmith. Some of the more common problems include poor accuracy, binding of the breech bolt, feeding problems, misfiring, defective safety, and failure to extract and eject.

Chapter 14 shows ways to improve the accuracy of a firearm. Binding of the breech bolt can be caused by burrs on the action mating surfaces, or the bolt may be fitted too tightly in the receiver. The most probable cause of feeding problems is a tight extractor, but any adjustments to the extractor must be done with care. Take off only one or two files strokes at a time, and then try it for fit. Too much filing can cause additional malfunctions.

Misfiring can be caused by defective ammunition, debris in the firing-pin channel, a weak or broken firing pin spring, or a worn or broken firing pin. Excessive head space can also cause misfiring. A good cleaning of the bolt will normally solve the problem, but replace or repair all worn or broken parts.

Most center-fire cartridge cases swell when fired, and if the chamber is dirty or pitted, the case will have a tendency to stick. When this sticking occurs, a worn extractor hook can slip over the case head or rim when the bolt is withdrawn, leaving the fired case in the chamber. Sometimes, if the wear is not too bad, the problem



can be corrected by honing the extractor hook angle to sharpen it. In doing so, however, be careful not to remove too much metal. Proceed on a trial-and-error basis until the extractor functions properly. Also check the extractor ring for tension and adjust it to acquire the proper bite.

When a rifle fails to eject a cartridge, chances are the ejector is binding in its cut in the receiver; the cut may be too narrow or the ejector may be bent. A binding ejector spring may not be functioning properly, or the slot for the ejector in the bolt may not be in line with the ejector. See that the parts are free and functioning properly or replace as needed.

## **PUMP ACTIONS**

Malfunctions in pump rifles and shotguns are second in frequency only to semiautomatics. The biggest cause of problems in pump actions is the presence of dirt, dust, and assorted debris that, when combined with gun oil and grease, prevent proper operation. Therefore, at the first sign of any malfunction, strip the gun down to its basic action parts and degrease, unless, of course, obvious symptoms dictate otherwise. Follow the cleaning procedures found in chapter 3. Other problems found in pump rifles are a failure to feed properly, double-feeding, failure to retain cartridges in the magazine, sticking action bars, action fails to lock, failure to extract and eject, failure to fire, failure to cock, firing on closing the action, and malfunctioning.

## **SEMIAUTOMATIC FIREARMS**

Semiautomatic guns are becoming popular among shooters and hunters and are outselling most other types two to one. This type of action will also malfunction two to one over any other types, but in most cases, a thorough cleaning will correct the problem. Table 2 gives solutions to other common malfunctions in semiautomatic rifles and shotguns.

## **SINGLE-SHOT, BREAK-OPEN SHOTGUNS**

Most problems that occur in break-open shotguns will be due to worn-out parts caused by general misuse of the gun and continual firing of high-brass shot shells in the older models.

**Table 2**  
**COMMON MALFUNCTIONS IN SEMIAUTOMATIC RIFLES**  
**AND SHOTGUNS**

<i>Malfunction</i>	<i>Probable Cause</i>	<i>Corrective Action</i>
Fails to fire	Broken or worn firing pin	Replace
Fails to extract	Broken or jammed extractor	Replace
Fails to eject	Weak or worn ejector	Replace
	Weak or broken ejector spring	
Feeding problems	Distorted magazine	Replace

Besides loose actions, the two most frequent problems occurring with this type gun are broken trigger springs and broken or weak locking bolt springs. A broken trigger spring is easily detected by the action of the trigger. If the trigger does not spring back after it is pulled, the problem is usually caused by a broken trigger spring. Of course, if a gun looks dirty, clean it before starting your diagnosis.

To replace the trigger spring, remove the butt stock; then using a ratchet screwdriver unscrew the trigger spring screw which is located on the bottom of the receiver tang on most guns of this type. Replace with a new spring and retighten the screw.

The locking-bolt spring in most single-barrel shotguns can be reached through the front of the receiver. Remove the forearm, break the gun open, remove the barrel, and you might be able to reach it. On some guns, however, you will have to remove some of the interior parts of the receiver in order to get at the locking bolt spring and its screw.

A worn or broken firing pin is another common problem with many older shotguns. The pin is easily replaced by removing the firing-pin stop screw and slipping the firing pin and spring out of its channel. Replace with a new one in the reverse order.

## DOUBLE-ACTION REVOLVERS

The mechanisms of double-action revolvers are more complex than either single-action or semiautomatic handguns, and require a high degree of skill to repair and adjust them. However, many of the problems that develop can be corrected by a thorough cleaning.

This preliminary cleaning and inspection should be followed by a complete disassembly of the revolver and an inspection for wear, damage, or missing parts. Problems to look for include a misaligned cylinder, incorrect timing, a broken or weak spring, a bent ejector rod, an improperly fitted cylinder latch, failure of the cylinder to lock, worn locking slots in the cylinder, and skipping.

## SEMIAUTOMATIC HANDGUNS

As with other firearms, a good cleaning will usually put an ailing semiautomatic pistol back into shooting condition, although other problems do develop that will require a good knowledge of troubleshooting. Such problems include failure to feed, extract, and eject. Poor accuracy may also occur in a firearm that is worn or in need of repair.

It would take several volumes to come anywhere near a complete reference source for troubleshooting. For a better understanding of detecting and correcting problems that develop in firearms of all kinds, buy a copy of *Learn Gunsmithing: The Troubleshooting Method*, available from Winchester Press, P.O. Box 1260, Tulsa, OK 74101. This book gives solutions to many malfunctions that commonly occur on every type of firearm manufactured.





## **Improving Accuracy**

A CENTER-FIRE OR rim-fire rifle must be able to obtain a certain degree of accuracy to be useful; the degree of accuracy will depend upon what the intended use of the rifle will be. For example, a rifle used to hunt deer and black bear in the eastern United States should group its rounds within a 2-inch circle at 100 yards. For longer range shooting, as encountered when hunting game in the western states, a rifle should group its rounds within 1 inch at the same range. However, rifles with these capabilities are also useful for competitive bench-rest shooting.

The bolt-action rifle, with one-piece stock, is considered to be the most accurate rifle ever made, while lever-actions, with two-piece stocks, are the least accurate. However, when any rifle does not group within its capabilities, something is wrong. With old rifles or ones that have been used heavily, it is likely that the rifling is shot out or pitted so badly that accurate shooting will be difficult;

or perhaps metal fouling is the culprit. The only way to be certain what the problem is is to check the bore thoroughly with a bore light.

In the case of bolt-action rifles, check the stock after inspecting the bore. If the stock is warped and the barrel does not line up properly in the barrel channel, coat the bottom of the barrel with Prussian blue or inletting black, applied in a thin, even coat. Then insert the barrel carefully into the barrel channel of the stock; any high spots or interference in the barrel channel will be clearly marked. Scrape away any high spots, and repeat the trial until no marks appear on the wood. Of course, if the stock is too badly warped, it should be replaced.

In most cases, the barrel of bolt-action rifles should bear on the bottom of the barrel channel only at the fore-end tip. This bearing point can be from a point of contact up to about 1/2-inch. Glazed spots in the barrel channel indicate barrel contact with the wood. Again, Prussian blue or inletting black coated on the barrel shows these spots readily. Any interference points should be scraped away using inletting tools. Note particularly the area around the point where the barrel joins the receiver.

## **BORE PROBLEMS**

When metal fouling is evident, try using J-B Bore Cleaner first. Another metal fouling solution has been around for a long time, but is not recommended to the hobbyist because many amateurs have ruined the finish on their firearm by spilling the solution on the gun. For those who want to try it anyway here are the ingredients:

- 1 ounce ammonium persulphate
- 200 grams ammonium carbonate
- 6 ounces stronger ammonia
- 4 ounces distilled water

Follow the directions carefully, and be extremely careful. Mix the ingredients in a large glass bottle and let it stand. Then carefully plug the chamber end of the rifle with a rubber, plastic, or cork plug. Secure the barrel and action in a well-padded vise with the barrel pointing upward and the butt on the floor. Insert a plastic funnel into the muzzle end of the bore and carefully pour the solution into the barrel until it is just about full—not quite to the funnel spout.



Again, be careful not to get any of the solution on the outside of the barrel. Allow the solution to remain in the bore about thirty minutes, and all metal fouling should be removed. Then pour all of the solution out—again being careful not to spill any—and rinse the barrel thoroughly with hot water. The hotter the water the better; the barrel should dry almost instantly. When dry, lightly oil the bore to protect it from rust.

A bore that shows signs of pitting can be restored somewhat by lapping. This operation is usually considered a little advanced for the beginner, but it can be done if care is taken.

Use a steel rod in the barrel that is slightly smaller than the bore diameter and notched lengthwise and crosswise at one end. A steel cleaning rod with swivel handle is ideal. The end opposite the notching should be set in a cross-handle with a ball bearing to allow the rod to turn freely and follow the twist of the rifling as it is pushed through the bore.

First clean the barrel of all foreign matter, including metal fouling. Then apply a film of light gun oil.

Wrap cotton string tightly around the notched end of the rod, which is fluxed at the tip with solder flux. Push the rod through the barrel from the breech end until it is within an inch of the muzzle. The cotton string should fit the bore snugly. Heat the first few inches of the muzzle to a medium temperature; but not high enough to color the blueing. Then pour molten lead into the barrel, filling about the first three inches of the barrel, which is the distance from the cotton string to the rod tip. When cool, push the lead a short distance out of the muzzle, but not all the way, to be trimmed.

Coat this lead slug, known as the *lap*, with oil and carefully push it a couple of inches out of the muzzle, leaving about one inch in the bore. Oil the lap again, then apply an abrasive compound, such as that offered by Clover. Rottenstone will work also. Work the lap back and forth through the bore from ten to perhaps thirty times, recoating with more abrasive after every ten cycles. Push the lap through the bore with steady tension until the barrel has the same feel for the entire length. Then, remove the lap and clean it with solvent. Now, measure (or *slug*) the barrel to see what the bore and groove diameter. You can then cast lead bullets to exactly fit the resulting diameters.

Lapping a rifle barrel is not as easy as it sounds. In fact, most

gun owners prefer to leave the job to professional gunsmiths. If you do try this operation, practice on an old discarded barrel first to get the feel before attempting the operation on a good barrel. It is possible to polish the barrel oversize and make the accuracy worse than it was to start with.

## CROWNING THE BARREL

Earlier in this book it was mentioned that a damaged barrel muzzle can affect accuracy, and the only solution was to cut the muzzle back a bit and recrown the barrel. Crowning serves two purposes. It offers a certain amount of metal between the very end of the barrel and the rifling, which serves to protect the rifling. The second and most important purpose, however, is to insure that the end of the bore is absolutely true and square. Unless the end of the barrel is true with the bore, a jet of propellant gas will escape from one side of the bullet first, tipping the bullet as its base merges from the bore.

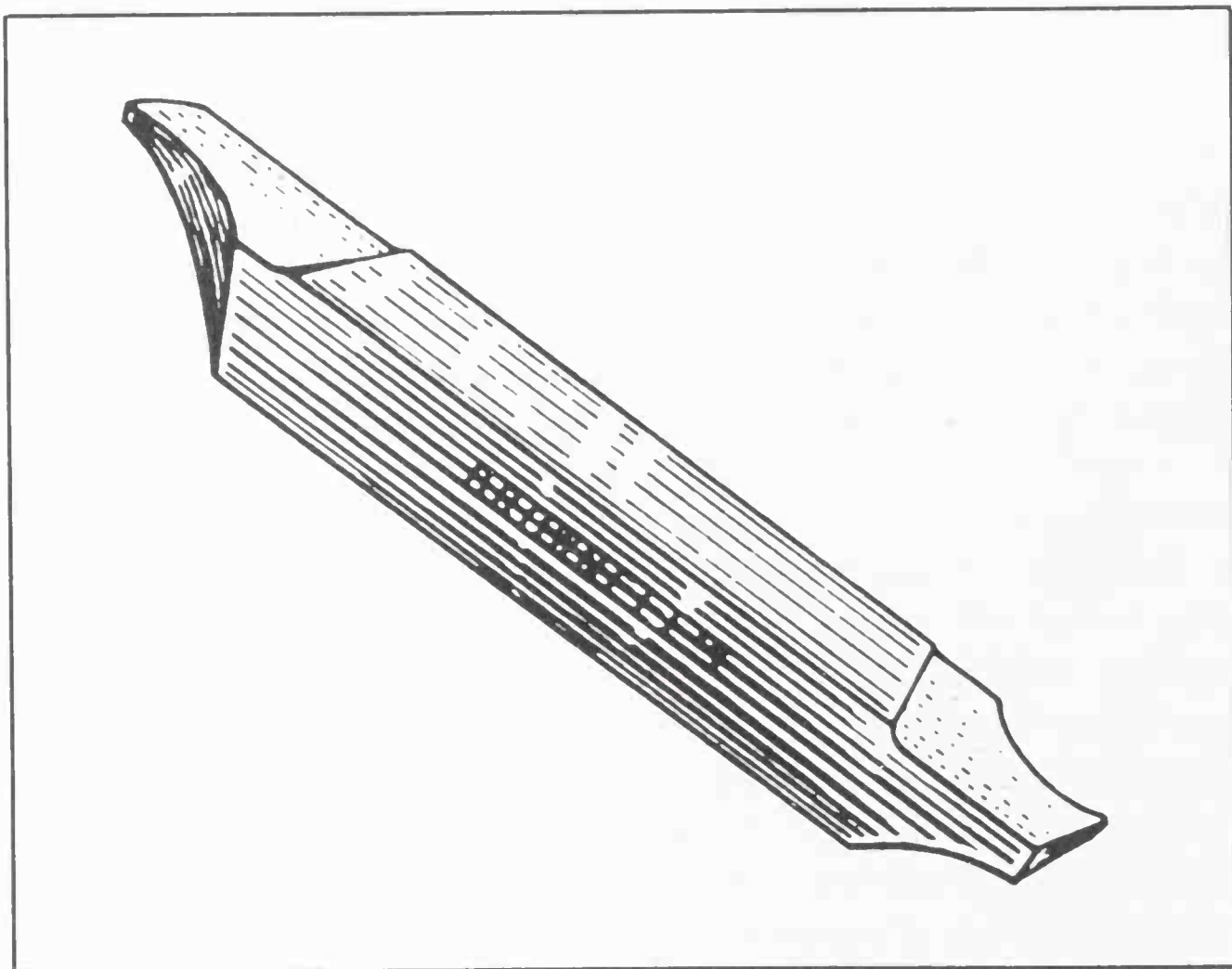


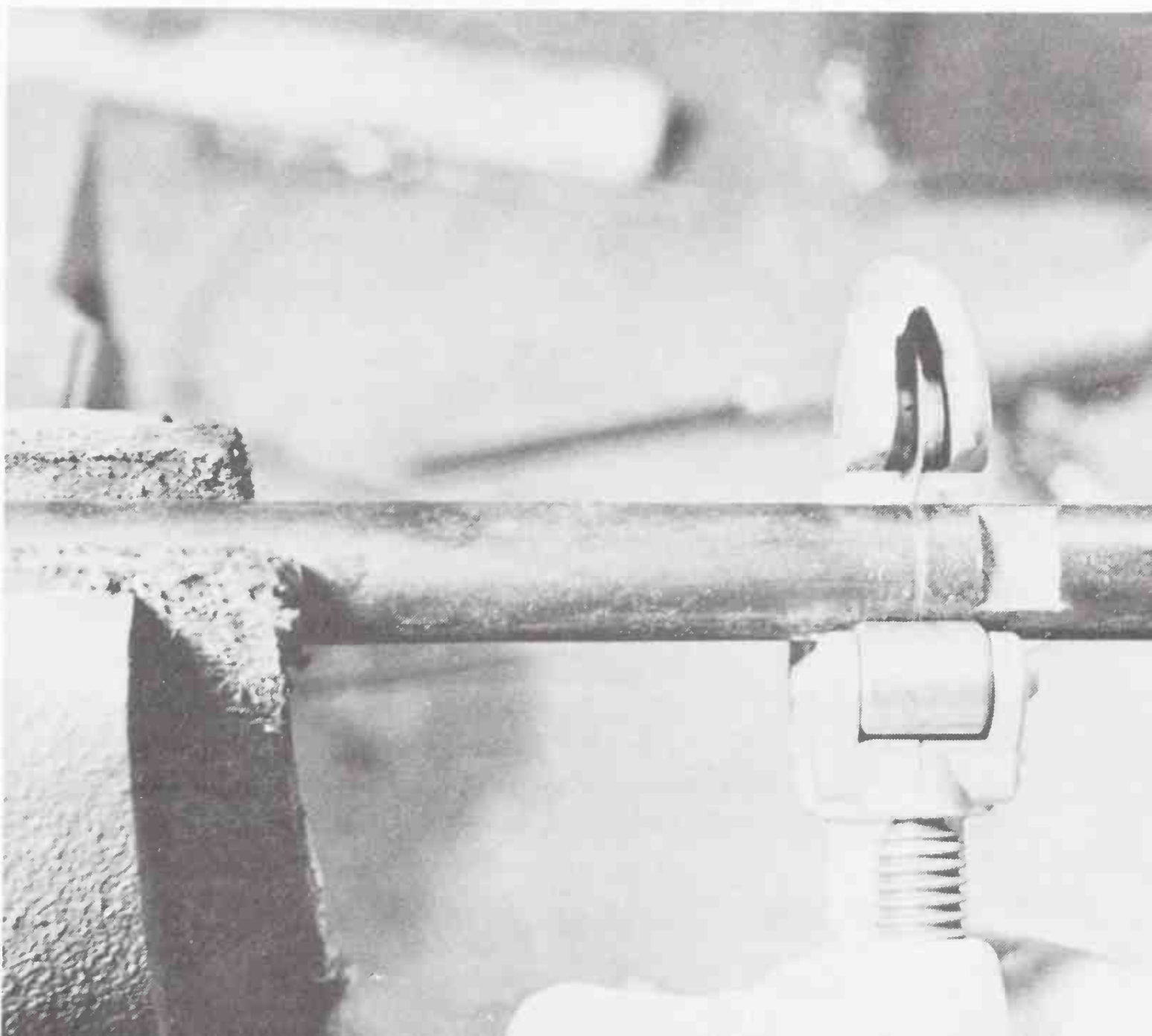
Fig. 14-1. If a lathe is available, Brownell's Muzzle Crowning Bit used in the lathe is the best and quickest way to crown a muzzle.

A professional gunsmith uses a lathe to true and crown a rifle muzzle as this is the fastest and easiest way to go about it. In fact, nearly every rifle that goes into a shop for rebluing also has its muzzle crowned. The gunsmith normally uses a spinning fixture to spin the barrel during polishing, the tips of this spinning fixture usually mar the muzzle slightly. So after the polishing is completed, the barrel is chucked in the lathe and a new crown cut.

The hobbyist can duplicate a professional-looking crowning job with simple hand tools—a hacksaw, a hand drill, masking tape, a rotary file, and a brass crown ball. I also like to use a roller pipe cutter to true the barrel if I am cutting off enough to allow the tool to clamp onto the barrel. If there is not enough barrel beyond the cut to clamp the pipe cutting tool, I merely eyeball it. It is very difficult to cut a true cut with a hacksaw anyway.

Cut the barrel back about  $\frac{1}{8}$  inch to  $\frac{1}{4}$  inch, depending upon the depth of the defect in the muzzle. Try to make this cut as true

Fig. 14-2. A pipe cutter is used to score the barrel prior to cutting.





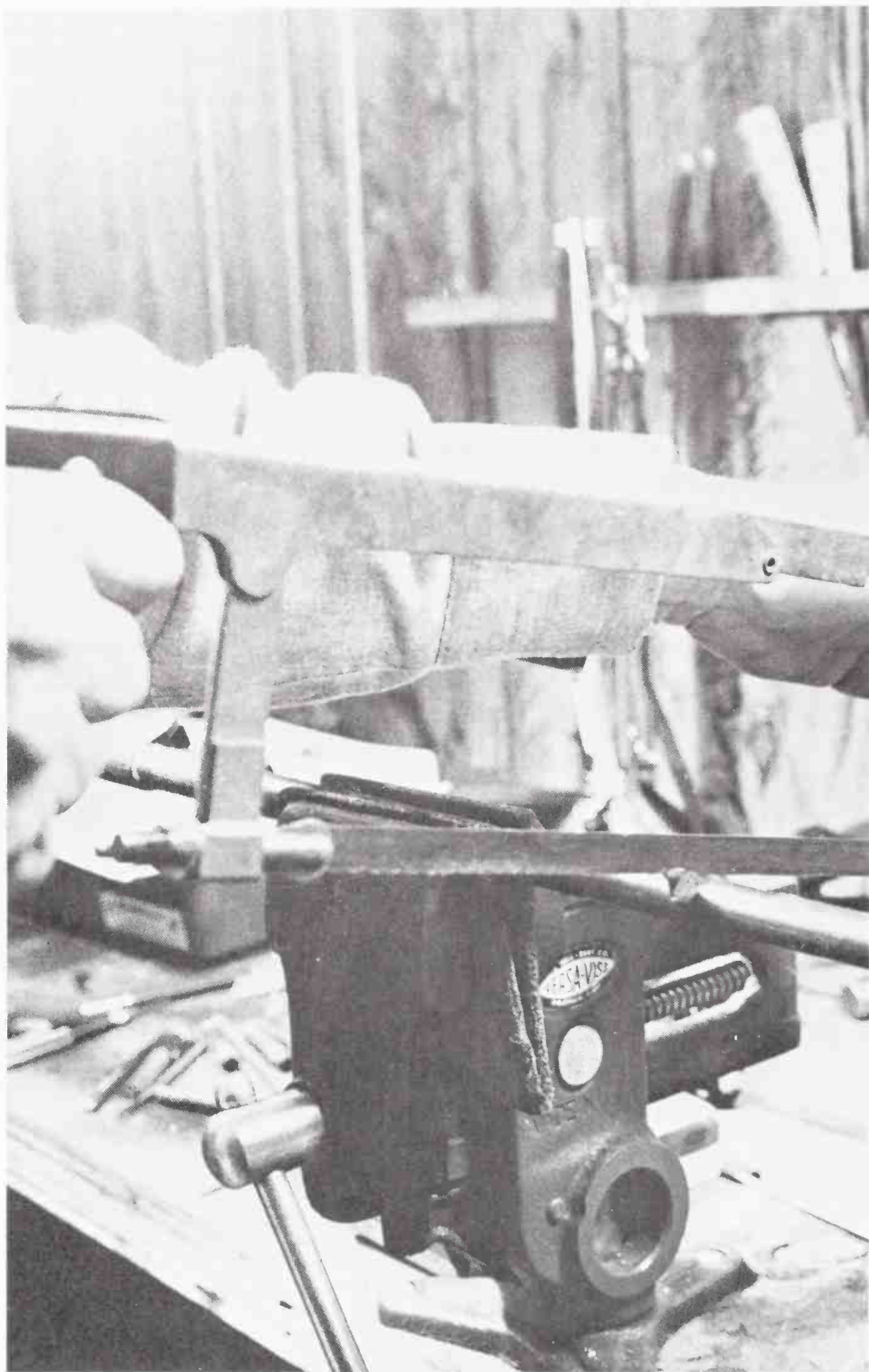


Fig. 14-3. The barrel is cut with a hacksaw as square as possible.



Fig. 14-4. Rough edges from the saw cut can be smoothed up with a file.

as possible, but don't worry if you are off a mite; that can be taken care of in the next step.

Secure the barrel in a bench vise so the muzzle is pointing upward (in a vertical position) and use a mill file to true the muzzle as near as possible. Check your work often with a *try square*, a basic measuring tool available at any hardware store.

Chuck the rotary file in your hand drill. Turn the hand crank of the drill to rotate the file, while at the same time moving the handle of the drill in a circular motion. This double motion on the rotary file will prevent scoring and will result in a perfect cut. Replace the rotary file with a brass ball, coating it with Clover or other

lapping compound. Lap the muzzle until all marks from the rotary file are smoothed out. Use exactly the same motion with the hand drill as you did when cutting the muzzle with the rotary file. If care is taken, you will have a perfect crowned muzzle.

## RECOIL-REDUCING DEVICES

It is difficult for the beginner (and some seasoned professionals) to obtain Minute of Angle groups with heavy recoil rifles, like some of the large-belted magnums. When each shot from one of these magnums rattles the shooter's teeth, it is not conducive to steady trigger squeezing!

One solution to the heavy recoil problem is to install a muzzle brake, a slotted tube that is attached to the muzzle of a rifle to trap escaping gases and use them as a counter-recoil force, thereby reducing recoil and, to some extent, muzzle jump. At one time, these devices were readily available and required the muzzle of the rifle be threaded on a lathe to accept the threads of the muzzle brake. The brake was then retained in position by friction between the brake and a matching shoulder on the barrel.

In recent years, muzzle-recoil reducers are being installed directly into the existing muzzle. Ports are drilled into the muzzle to allow some of the gas to escape before it reaches the muzzle. The counter-recoil force of the escaping gases tends to reduce the apparent recoil. This type of muzzle brake is, however, strictly for the experienced specialist, not for the beginner.

A better choice for the beginner is to install one of the recoil reducers that fit in the stock, forearm, or magazine. This, in most cases, requires only the removal of some wood from the stock to install. The three most popular models available are Flinch-X Recoil Buffers for shotguns and rifles; Hiram's "Bear Trap" Hydraulic Recoil Reducer, and C & H Research Mercury Recoil Suppressor. All of these give the same results although each operates in a slightly different manner.

The Flinch-X reduces recoil, stops muzzle bounce and weighs only 7  $\frac{3}{4}$  ounces. It is easily installed in the butt stock and some shooters put one in the forearm also for even greater reduction of recoil. It works on pneumatic action.

Hiram's "Bear Trap" is a hydraulic-cushioned recoil reducer designed to effectively tame recoil while the C & H model uses



mercury, one of the heaviest elements, to suppress recoil. The moving mercury provides the greatest amount of movable weight to counteract recoil. Both of these models are installed in the butt stock by drilling a hole the required depth using a spud point wood drill. The C & H design also has models that fit in shotgun magazines. They are used to replace the magazine plug, reducing recoil at the same time.

Another factor that will eliminate "felt" recoil is good stock design. The little "thutty-thutty" can kick the dickens out of shooters when the stock does not fit and is not shaped correctly. On the other hand, rifles chambered for the .458 Winchester magnum can be found that were fitted with a good, straight stock design that are not at all unpleasant to fire.

## **STOCK BEDDING**

Probably the most noticeable single factor contributing to good accuracy is stock bedding; that is, the metal-to-wood fit. For the best accuracy, the rear and bottom surfaces of the recoil lug must fit exactly into the stock, guard screws must be kept tight, and the receiver must fit tightly to eliminate any motion in the stock upon firing. The master stock maker can fit the metal to wood so that the best accuracy can be expected from the rifle, but the work is costly. The amateur cannot do as well, since years of experience are required to obtain perfect results. Glass bedding is recommended for the beginner. This synthetic resin material molds to a perfect fit and is very tough. There are several kits on the market, but the only one that I have tried has been the Brownell Acraglas<sup>R</sup> kit. This worked so well that it was unnecessary to try any others. The kit can be used for bedding in new stocks, repairing broken stocks, and filling gouges or deep dents in stocks, but its most important use is to make a rifle shoot more accurately.

When using Acraglas for inletting allow a  $\frac{1}{16}$  to  $\frac{1}{8}$ -inch clearance in the barrel channel and behind the recoil lug. Leave the wood rather rough as this will add strength by creating more exposed wood surface for the Acraglas to come in contact with. Prepare the metal surfaces so you can disassemble the rifle once bedded. Without a release agent, a sledge hammer is the only hope for getting the barrel and action out of the stock. A release agent comes with the

kit; use this agent on all metal surfaces that might come in contact with the Acraglas. Apply two coats.

Any recesses in the metal should be filled with putty or modeling clay to prevent them filling with Acraglas during the bedding operation. Smooth these fills so they are flush with surrounding surfaces and then cover with waterproof tape such as Scotch No. 88 Electrical Tape. Apply the release agent over the tape. Apply a thin coat of gun grease or paste wax over the guard screws after the release agent has dried. Be sure that the release agent is thoroughly dry before starting the bedding job. When the bedding job is finished, the release agent can be removed from both gun and glass bedding with warm water.

Mix the bedding compound according to instructions that come with the kit. Using a paddle, spread the prepared Acraglas in a ridge down the center of the barrel channel to prevent air from being trapped when the barrel is seated. Also fill the recoil lug recess sufficiently to fill the recess when fitted. Now carefully insert the barrel and action and press into the stock to the desired depth.

In an hour or two, when the bedding compound shows signs of hardening, remove all surplus Acraglas with a dull knife or spatula, being careful not to scratch the gun blueing nor the stock finish in the process. On new stocks, leave a very small bead of Acraglas above the wood between the stock and metal to be sanded to the contours of the stock after final curing.

Under normal conditions, the gun can be removed from the stock in two or three days. Do not expect the barrel and action to lift out easily. Even with adequate release agent applied, the fit is going to be tight,) the way it should be, and you are going to have to strain a little to get the metal and wood apart. A soft rubber mallet will help. Grip the stock firmly and then pound under the barrel, immediately ahead of the forearm, until the metal parts break loose. The barrel and action should then lift out relatively easily.

Once the gun and stock are apart, inspect your work carefully. If you find voids such as bubbles or missed places, mix a new batch of compound and touch up these areas before rebedding the barrel and action. These areas will then be as tough as the rest of the bedding. Just be sure that the areas to be filled are free of release agent before applying the Acraglas.

When Acraglas is properly applied, broken or split stocks can be as strong as, or stronger than, when new. When filling gouges or bad dents in stocks, add Floc to strengthen the fill. Color can be added to closely match the existing stock finish. In doing so, however, it is best to have the Acraglas a little lighter than the wood.

In repairing a gunstock for a Winchester prewar Model 70 that had been rechambered to .270 Weatherby, the barrel was first removed. Then the action was removed from the stock and the barrel and receiver channels were cleaned. A small "V"-shaped channel was cut down a crack inside the stock to offer more contact with the bedding compound. The stock had cracked almost all the way through from the barrel lug screw hole to the magazine cutout in the bottom of the stock. A batch of Acraglas was mixed according to directions and the stock was clamped in a bench vise. A wooden dowel was used to hold the crack open while the mixed Acraglas was being applied. It ran down inside the crack and thoroughly covered every surface of the cracked wood. When a reasonable amount had been applied, the stock was repositioned in the vise so that the jaws of the vise applied pressure to the sides of the stock adjacent to the crack, pulling the crack together. All excess compound was wiped from the stock, release agent was applied to the barrel and action, and the gun was reinstalled into the stock. Thirty-six hours later the gun was once again removed from the stock and the repair examined. Everything was perfect. This repair prevented the stock from cracking further and slightly improved its accuracy.

## **TRIGGER WORK**

Trigger pull is another factor that can affect accuracy in a rifle. It should be smooth and even for best results. Refer to chapter 9 for a complete description of trigger repairs and alterations.

## **SIGHTS**

Good sights are necessary for good accuracy and these must be zeroed properly for best results. Refer to chapter 8 for complete coverage of telescopic sights and techniques for their installation.

Accuracy can also be improved if you study the ballistic tables of your particular cartridge. For example, if you shoot a .243 Winchester with a 100-grain bullet and your rifle is sighted in for 100



yards, you will know that you can hold dead on a target at any range from the muzzle to 150 yards and not be more than an inch off either way, high or low. At 200 yards, you will be about 3 inches low from the point of aim and you may want to make adjustments. At 300 yards, you will want to hold about 10 inches over your target. Once you know these facts and can judge range accurately, you should be able to hit anything from 0 to 300 yards.

# Appendix

## GUNSMITH SUPPLIES, TOOLS, SERVICES

Albright Products Co.  
P.O. Box 1144  
Portola, CA 96122

Alley Supply Co.  
Carson Valley Industrial Park  
Gardnerville, NV 89410

Ames Precision Machine Works  
5270 Geedes Road  
Ann Arbor, MI 48501

Anderson Mfg. Co.  
P.O. Box 3120  
Yakima, WA 98903

Armite Labs  
1845 Randolph Street  
Los Angeles, CA 90001

Atlas Press Co.  
2019 N. Pitcher Street  
Kalamazoo, MI 49007

B-Square Co.  
Box 11281  
Fort Worth, TX 76110

Jim Baiar  
490 Halfmoon Road  
Columbia Falls, MT 59912



Behlert Custom Guns, Inc.  
725 Lehigh Avenue  
Union, NJ 07083

Al Biesen  
W. 2039 Sinto Avenue  
Spokane, WA 99201

Bonanza Sports Mfg. Co.  
412 Western Avenue  
Faribault, MN 55011

Brookstone Co.  
125 Vose Farm Road  
Peterborough, NH 03458

Bob Brownell's  
Main & Third  
Montezuma, IA 50171

W. E. Brownell  
1852 Alessandro Trail  
Vista, CA 92083

Maynard P. Buehler, Inc.  
17 Orinda Highway  
Orinda, CA 94563

Burgess Vibrocrafters, Inc.  
Route 83  
Grayslake, IL 60030

M. H. Canjar  
500 E. 45th  
Denver, CO 80216

Chapman Mfg. Co.  
Route 17 at Saw Mill Road  
Durham, CT 06422

Chase Chemical Corp.  
3527 Smallman Street  
Pittsburgh, PA 15201

Chicago Wheel & Mfg. Co.  
1101 W. Monroe Street  
Chicago, IL 60607

Christy Gun Works  
875-57th Street  
Sacramento, CA 95819

Clover Mfg. Co.  
139 Woodward Avenue  
Norwalk, CT 06856

Colbert Industries  
10107 Adella  
South Gate, CA 90280

A. Constantine & Son, Inc.  
2050 Eastchester Road  
Bronx, NY 10461

Dave Cook  
720 Hancock Avenue  
Hancock, MI 49930

Cougar & Hunter  
G 6398 W. Pierson Road  
Flushing, MI 48433

Alvin L. Davidson  
Products for Shooters  
1215 Branson  
Las Cruces, NM 88001

Dayton-Traister Co.  
P.O. Box 593  
Oak Harbor, WA 98277

Decker Shooting Products  
1729 Laguna Avenue  
Schaofield, WI 54476

Dremel Mfg. Co.  
4915-21st Street  
Racine, WI 53406

Chas. E. Duffy  
Williams Lane  
West Hurley, NY 12491



Peter Dyson Ltd.  
29-31 Church Street  
Honley, Huddersfield  
Yorksh, HD72AH England

E-Z Tool Co.  
P.O. Box 3186  
25 N.W. 44th Avenue  
Des Moines, IA 50313

Edmund Scientific Co.  
101 E. Glouster Pike  
Barrington, NJ 08007

F. K. Elliott  
Box 785  
Ramona, CA 92065

Emco-Lux  
2050 Fairwood Avenue  
Columbus, OH 43207

Forster Products Inc.  
82 E. Lanark Avenue  
Lanark, IL 41046

Keith Francis  
P.O. Box 537  
Talent, OR 97540

GRS Corp.  
Box 1157  
Boulder, CO 80302

Gager Gage & Tool Co.  
27509 Industrial Boulevard  
Hayward, CA 94545

Gilmore Pattern Works  
P.O. Box 50231  
Tulsa, OK 74150

Gold Lode, Inc.  
181 Gary Avenue  
Wheaton, IL 60187

Gopher Shooter's Supply  
Box 278  
Faribault, MN 55021

Grace Metal Products  
115 Ames Street  
Elk Rapids, MI 49629

Gunline Tools, Inc.  
719 N. East Street  
Anaheim, CA 92805

H. & M.  
24062 Orchard Lake Road  
Box 258  
Farmington, MI 48024

Half Moon Rifle Shop  
490 Halfmoon Road  
Columbia Falls, MT 59912

Hartford Reamer Co.  
Box 134  
Lathrup Village, MI 48070

Paul Jaeger, Inc.  
211 Leedom Street  
Jenkintown, PA 19046

Jeffredo Gunsight Co.  
1629 Via Monserate  
Fallbrook, CA 92028

Jerrow's Inletting Service  
452 Fifth Avenue N.E.  
Kalispell, MT 59901

JET Machinery  
1901 Jefferson Avenue  
Tacoma, WA 98402

Kasenite Co., Inc.  
3 King Street  
Mahwah, NJ 07430

J. Korzinek  
RD# 2 Box R  
Canton, PA 17724

LanDav Custom Guns  
7213 Lee Highway  
Falls Church, VA 22046

John G. Lawson  
1802 E. Columbia Avenue  
Tacoma, WA 98404

Lea Mfg. Co.  
237 E. Aurora Street  
Waterbury, CT 06720

Lightwood & Son Ltd.  
Britannia Road  
Banbury, Oxfordsh.  
OX1 68TD, England

Lock's Philadelphia Gun Exchange  
6700 Rowland Avenue  
Philadelphia, PA 19149

Marker Machine Co.  
Box 426  
Charleston, IL 61920

Michaels of Oregon Co.  
P.O. Box 13010  
Portland, OR 97213

Viggo Miller  
P.O. Box 4181  
Omaha, NE 68104

Miller Single Trigger Mfg. Co.  
R.D. of Rt. 209  
Millersburg, PA 17061

Frank Mittermeier  
3577 E. Tremont  
New York, NY 10465

Moderntools Corp.  
Box 407  
Dept. GD  
Woodside, NY 11377

Montgomery Ward  
Baltimore, MD 21299

MMC Co.  
212 E. Spruce Street  
Deming, NM 88030

MTI Corp.  
11 East 26th Street  
New York, NY 10010

N & J Sales  
Lime Kiln Road  
Northford, CT 06472

Karl A. Neise, Inc.  
5602 Roosevelt Avenue  
Woodside, NY 11377

Oehler Research Inc.  
P.O. Box 9135  
Austin, TX 78766

Palmgren Products  
Chicago Tool & Eng. Co.  
8383 South Chicago Avenue  
Chicago, IL 60167

Panavise  
Colbert Industries  
10107 Adelia Avenue  
South Gate, CA 90280

C. R. Pedersen & Son  
Ludington, MI 49431

Ponderay Lab  
210 W. Prash  
Yakima, WA 98902



Redford Reamer Co.  
Box 40604  
Redford Hts. Station  
Detroit, MI 48240

Richland Arms Co.  
321 W. Adrian Street  
Blissfield, MI 49228

Riley's Supply Co.  
121 N. Main Street  
Alvilla, IN 46710

Ruhr-American Corp.  
S Hwy. #5  
Glenwood, MN 56334

A. G. Russell  
1705 Highway 71N  
Springdale, AR 72764

Schaffner Mfg. Co.  
Emsworth  
Pittsburgh, PA 15202

Schuetzen Gun Works  
624 Old Pacific Highway  
Olympia, WA 98503

Sears Roebuck & Co.  
Philadelphia, PA

Shaw's  
Rt. 4 Box 407-L  
Escondido, CA 92025

L. S. Starrett Co.  
Athol, MA 01331

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# GLOSSARY

**Action** The breech mechanism of a firearm through which it is loaded. The action also secures the cartridge or shell in the chamber to prevent discharge to the rear.

**Action, Bolt** A breech-action gun that operates by a bolt which locks the cartridge in the chamber of the barrel and also ejects the cartridges when the bolt is open.

**Action, Lever** A breech-action that is opened, closed, and operated by means of a lever, usually formed as a rearward extension of the trigger.

**Action, Pump** A breech-action gun that is opened, closed, and operated by means of a sliding fore-end which is formed into a convenient handle for this purpose. This type of action is also called trombone or slide-action.

**Automatic** A term commonly used for a self-loading firearm. A better term is semiautomatic or autoloading because a firearm is truly automatic only when it continues to fire as long as the trigger is held back—like in a machine gun.



- Barrel** The part of a firearm that holds the powder charge, wadding, and bullet before firing and acts as a guide for the bullet upon firing.
- Black Powder** Mixture of charcoal, sulphur, and saltpeter; grains are coated with graphite.
- Blow-Back** A type of recoil-powered semiautomatic action in which the shell or cartridge casing blows back against the breech block causing it to open. Such an action is used only in low-powered guns, such as .22 rim-fire rifles and some handguns.
- Blueing** The process done to metal parts on firearms to dull the bright steel color of exposed metal parts and also helps prevent rust.
- Bore** The hole through the barrel of a firearm measured from land to land. In rifled barrels, the groove diameter is the distance between opposite grooves.
- Break-Open Shotgun** Shotgun action in which the gun opens at the breech, tipping the rear of the barrel upward to where the shells are placed in the chamber; barrels then lift up until locked in place. Some of these actions have also been converted to fire centerfire rifle cartridges.
- Breech** The rear end of the bore of a firearm where the cartridge is inserted into the chamber.
- Breech-Bolt** Part of the action that closes the breech and sustains the head of the cartridge when the gun is fired.
- Browning** Process similar to blueing that gives the traditional brown finish found on muzzle-loaders and Damascus barrels.
- Bullet** The projectile fired from a rifle or handgun.
- Butt** The part of the gunstock that comes in contact with the shoulder of the shooter.
- Button Rifling** Method of rifling in which a special button, similar in shape to a bullet, is drawn through a barrel blank to create the grooves.
- Butt Plate** The plate of hard rubber, steel, aluminum, or synthetic material that is attached to and protects the rear end of the butt stock. Butt pads are used to soften the feel of recoil from shotguns and rifles.
- Caliber** Principally the bore (or land-to-land) diameter of a barrel; not the actual bullet diameter in modern usage. Used to refer to the actual designation of a cartridge such as, "caliber .257 Roberts." Also a unit of measure to describe bullet nose shape; that is, "4-caliber ogive or seating depth," "1-caliber seating depth," and in big-gun terms, barrel length in units of bore diameter. A 50-caliber, 6-inch gun has a barrel that is 50 times 6 inches or 300 inches (25 feet) long.
- Cant** Leaning of a rifle to one side or the other so that the sights are not in a truly vertical plane. As a result the bullet strikes the target on the side of the cant and slightly low.
- Cap** A percussion cap for use with cap-and-ball guns. Also, the cup and



priming-compound pettel of a conventional shotshell primer. Sometimes used in place of the word "primer."

**Carbine** A short-barreled rifle, like the Ruger .44 Magnum or Winchester Model 94.

**Carrier** The mechanism in a magazine or repeating firearm that carries the cartridge or shotgun shell from the magazine into a position to be pushed into the chamber.

**Cast-Off** A slant in a gunstock away from the face of a right-handed shooter.

**Cast-On** A slant in a gunstock toward the face of a right-handed shooter.

**Centerfire** Term used to identify a cartridge having its primer inserted in the center of the head of the shell or case.

**Center-Punch** Punch with a short, sharp point for marking metal, usually before drilling with bit. It is also sometimes used to pin dovetail sight bases to solve the problem of loose sights.

**Chamber** The enlarged portion of the bore, at the breech, in which the cartridge rests when in position to be fired.

**Checkering** Process of cutting a pattern into pistol grips and forearms of gunstocks.

**Checkering Cradle** This item is used to secure the gunstock during checkering so it can be rotated; also useful for stock inletting, sanding, staining, and finishing.

**Checkering Tools** used for fine-line checkering on stocks and forearms.

**Cheek Piece** A raised, carved portion of the butt stock on one side of the comb which the shooter can use as a cheek rest when aiming.

**Chilled Shot** Shot formed with an alloy of lead and antimony different from that used in drop shot.

**Choke** Classification determined by the amount of constriction created at the end of the barrel. Amount of choke is dependent on the number of shot that actually hits the target in comparison with the number that leaves the end of the barrel. Measured in terms of points.

**Chrome-Molybdenum Steel** Type of steel that withstands high pressure well; used for making gun barrels.

**Cock** To ready the hammer or firing pin of a gun so that it is in a position to fire.

**Comb** Top of the butt stock or part of the stock that extends from the heel to a point just behind the hand as the stock is grasped. A proper comb guides the face to a position where the eye falls quickly into the line of aim.

**Cone** The slope of the forward end of the chamber of a rifle or shotgun which decreases the chamber diameter to bore diameter. Sometimes, especially in shotguns, it is called the forcing cone.

**Copperized Shot** Type of shot covered with a copper plating done by an

electrolytic (plating) process, making the shot harder and more resistant to deformation.

**Crossbolt** Transverse bolt used to lock the standing breech and barrels of a side-by-side or over-under shotgun.

**Cylinder** The part of a revolver which contains the cartridge chambers and revolves so that each cartridge in turn lines up with the barrel to be fired.

**Damascus Barrels** Twisted steel barrels whose manufacture resulted in the grain of the metal appearing on the outside of the barrel in the form of irregular links or spirals creating intricate patterns; unsafe to use with smokeless powder.

**Double-Action Revolver** Cocks and fires with a single pull of the trigger. Most such revolvers can also be fired as a single-action type for better accuracy.

**Double-Kick** Jolts experienced from the two-part recoil of the long-recoil shotgun. One kick is felt when the shell is fired; the other when the barrel and breech slam home.

**Drooped-Wire Brush** Heavy brush made of bronze used to remove hard fouling and rust from barrels with ease.

**Drop** The distance a projectile falls due to the force of gravity. Drop must be corrected by means of sight adjustment for the difference between the line of sight and the line of departure. Drop also refers to the height between the line of sight and the top of the stock comb or heel.

**Drop Shot** Shot formed when molten lead is mixed with a small amount of arsenic.

**Dummy Cartridge** A cartridge case and bullet without powder or primer, used for testing the feed, extraction, and ejection of actions.

**Ear Protector** Plugs, acoustical muffs, or similar devices used to help eliminate the sound of gun shots.

**Eject** The action of throwing a cartridge from the breech after extraction. This is often accomplished by spring action.

**Ejector** A mechanism on firearms that ejects the fired or unfired shell clear of the gun.

**Elevation** A vertical sight adjustment to bring the point of aim to the proper elevation to compensate for bullet drop.

**Enfield Rifling** Type of rifling with a square shape that twists through the length of the rifle barrel.

**Engine Turning** The process of polishing circular spots on metal (usually rifle bolts) with a spinning abrasive rod.

**Engraving** The art of cutting patterns or designs into the metal parts of a firearm to improve its appearance and to increase its value.

**Extract** The process of removing a cartridge case from the chamber of the action.

- Extractor** The hooked device that withdraws the cartridge from the chamber when the breech mechanism is opened.
- Eye Relief** The optimum distance the eye must be held from the ocular lens of a telescopic sight to obtain a full field of view through the scope.
- Feed** The action of transferring cartridges from the magazine of a repeating or semiautomatic gun into the chamber of the barrel.
- Federal Firearms License** License that must be held by anyone who works on a firearm for other people.
- Firearm Transaction Record** Federal form covering the transfer of a firearm to a nonlicensed person.
- Firing Pin** The pointed nose of the hammer of a firearm—or the separate pin or plunger—that dents the primer of a cartridge or shell to fire the round.
- Flexible Brass Jag Tip** Type of tip for cleaning firearms; patch wraps around the jag causing the patch to press evenly on the bore squeezing oil into the pores of the steel.
- Florentine Finish** Gun engraving made by cutting crossed sets of lines.
- Forearm** The forward portion of a stock under the barrel that serves as the fore grip on the arm. Frequently called “fore-end.”
- Frame** The framework of a firearm to which the barrel and stock are fastened and in which the breech, lock, and reloading mechanisms are located.
- Freebore** The unrifled portion of the barrel between the rifling and the end of the chamber.
- Gallery** The term usually applied to an indoor rifle or handgun range.
- Gas-Cutting** The escape of propellant gas between a bullet and the bore of the barrel, usually caused by the bullet being undersized for the bore.
- Gas-Operated Action** Method of powering a semiautomatic action in which the rifle operates off the gas generated by the expansion of gun powder.
- Gauge** Refers to the size of the barrel bore in a shotgun.
- Glass Bedding** The reinforcing of a wooden gunstock by adding a fiberglass-epoxy compound to strengthen the stock and improve accuracy and consistency of point of bullet impact. The compound is also useful for repairing broken stocks.
- Grip** The small part of the stock (often called the wrist) to the rear of, or just below, the action where the hand of the shooter grasps the firearm for shooting.
- Group** A number of consecutive shots, usually five or ten, fired at a target with constant aim and sight adjustment; their bullet holes making a group on the target.
- Guard Screw** The screws that hold the action and trigger guard to the stock.



**Gun Control Act** Regulates firearms-related businesses.

**Gun Sling** Provides a comfortable means of carrying a firearm and also helps steady a weapon while being fired.

**Hammer** The part of a firearm that strikes either the cartridge rim or primer, or strikes the firing pin, driving it forward so that it indents the primer or rim of the cartridge causing it to discharge. The hammer is actuated by a mainspring and controlled by the trigger.

**Hammerless** Firearms having the hammer concealed within the breech mechanism; or, a firearm that has no hammer and is striker-fired; a spring activated firing mechanism.

**Hammer Rifling** Method of rifling in which the rifle barrel is pounded over a special mandrel to make the grooves.

**Head Space** The dimension in a firearm that determines whether the cartridge is tightly breeched in the chamber when the breech, breech block, or breech bolt is shut. When there is too little head space, the breech will not close on the cartridge. When there is too much, the firearm misfires and accidents occur. Excessive head space is dangerous and may result in injury. Head space can be checked with gauges available from gunsmith supply houses.

**Hinge** The joint in a break-down, breech-loading rifle or shotgun connecting the barrel or barrels with the frame.

**Inletting** Process for making a rifle stock from a blank by inserting the metal parts and chipping away the excess wood.

**Lands** That portion of the original bore surface of a rifle barrel that lies between the grooves.

**Leading** Metal fouling from lead bullets caused by a rough or pitted barrel.

**Leather Polisher Tips** Type of tip for cleaning firearms using buff leather disks; recommended because no metal touches the bore.

**Length of Stock** The distance in a straight line from the center of the trigger to a point midway between the heel and toe of the butt plate, on the surface of the plate. The stock length depends upon the shooter—short arms require shorter stocks.

**Lever Action** Rapid-firing, repeating rifles that use a magazine to feed ammunition.

**Line of Sight** The straight line passing from the eye through the sights to the target.

**Lock** Main mechanism on a muzzle-loading rifle that controls the ignition of powder in the barrel.

**Locking Bolt** The bolt used in a break-down, breech-loading gun to lock the breech in its closed position.

**Lock Speed** The time consumed between the releasing of the firing mechanism and the explosion of the cartridge.

**Loop** Upper portion of the gun sling; should be adjusted to within two inches of the butt swivel.

- Lug** A lug on the barrel of a break-down, breech-loading shotgun or rifle that secures the barrel to the frame. The lugs on the front of a bolt or breech block that rotate into slots to lock the action for firing are termed "locking lugs."
- Kentucky Rifle** One of the first rifles using spiral grooves in the barrel resulting in more accuracy.
- Magazine** A box or tube on or in a repeating firearm where the cartridges are carried in a position to be fed into the chamber by means of the reloading mechanism.
- Magazine, Box** Magazine in which the cartridges are stacked horizontally.
- Magazine, Full** A tubular magazine reaching the entire length of the barrel.
- Magazine, Half** A tubular magazine reaching half the length of the barrel.
- Magazine, Tubular** Magazine in which the cartridges are carried end-to-end in a tube located beneath the barrel or within the stock.
- Mainspring** The spring, either flat or coiled, that moves the hammer or firing pin forward to strike the hammer.
- Mannlicher Stocks** Stocks on which the forearm extends to the muzzle of the barrel; barrel lengths are commonly 18 to 20 inches.
- Matted Rib** A raised, solid rib along the top length of a shotgun barrel designed to cut reflection and improve sighting.
- Metal Fouling** A deposit of metal left by the bullet in the bore; can cause poor accuracy.
- Micrometer Reading** Sum of the readings of the graduations on the barrel and the thimble.
- Mounts** Metal bases and rings used to fasten a telescopic sight to the barrel or receiver of a weapon.
- Muzzle Brake** Installed on the barrel to reduce recoil; most use a precut outlet for surplus gas to escape.
- National Rifle Association** Organized group to lobby for gun legislation that will not hinder the rights of citizens to own firearms.
- Ordinance Steel** Steel with high tensile strength that is easy to machine; used for making barrels.
- Over and Under** A double-barrel shotgun or rifle with one barrel superimposed over the other.
- Pattern** Percentage of shot that hits within a circular target at a specified range.
- Pistol** A handgun in which the cartridge is loaded into a chamber in the barrel. Pistols may be single shot, repeating, or semiautomatic. When the cartridges are loaded in and fired from a revolving cylinder, the pistol is called a revolver.
- Pitch of Butt** The angle of the butt or butt plate in relation to the barrel. If, for example, the butt of a gun is rested on a flat surface on the floor

with the barrel in a vertical position, and the barrel muzzle is inclined at two inches from perpendicular, the butt is said to have a pitch of two inches.

**Plain Jag Tip** Type of tip used for cleaning firearms which gives a uniform cleaning action and reverses inside the barrel.

**Point** Refers to the 0.001 inch difference between the muzzle diameter and the bore diameter; measurement of choke.

**Powder** The finely divided chemical mixture that supplies the power used in shotgun and metallic ammunition. Originally, all propellant powder was black powder, which was formed in grains of different sizes, which determined the rate of burning and suitability for various cartridges in black powder arms. Modern powders are smokeless with base of nitroglycerine or nitrocellulose or a combination of both.

**Primer** The cap seated in the center of the base of a centerfire cartridge or shot shell that contains the igniting compound. When the primer is indented by the firing pin, the priming compound is crushed and detonates, thus igniting the charge of powder. Rim-fire cartridges contain the priming compound within the folded rim of the case, where it is crushed in the same manner.

**Projectile** A ball, shot, or bullet fired from a firearm.

**Pump Action** Mechanism that allows the shooter to cycle cartridges through without having to remove the trigger finger.

**Pump Gun** A repeating firearm having a slide action.

**Receiver** The frame consisting of breech, locking, and reloading mechanisms of shotguns or rifles.

**Recoil** Method for powering semiautomatic actions.

**Recoil Pads** Cushions the gun's recoiling kick as the gun is fired; can be used to extend the stock's length for better fit.

**Repeating Firearm** Any rifle, shotgun, or pistol, other than a revolver, having a magazine in which a reserve supply of cartridges is carried, and a repeating mechanism which when operated, ejects the fired cartridge case, replaces it with a loaded cartridge, and is ready to fire.

**Revolver** Firearm with a cylinder that rotates one chamber at a time allowing six to nine discharges.

**Rib** The raised bar, slightly concave on its upper surface, and usually matted, that forms the sighting plane extending the length of the barrel.

**Rifle** A shoulder-mounted firearm with the bore of its barrel cut with spiral grooves; the purpose of the grooves is to cause the projectile to rotate on its axis when fired, resulting in greater range and accuracy.

**Rifling** The spiral grooves in a barrel that impart spin to a bullet as it traverses the length of the barrel.

**Roll Jag Tip** Type of top for cleaning firearms; permits rolled or wrapped patches to be used; good for cleaning rifles that have to be wiped out from the muzzle end.



- Rolling-Block Action** Single-shot action in which the breech block pivots and rolls back to eject the fired cartridge and insert a new one.
- Safety** The device that mechanically locks a firearm against the possibility of discharge.
- Sear** The device in the lock of a firearm that holds the hammer or firing pin in its cocked position. When the trigger is pulled to the rear it disengages the sear, and releases the hammer or firing pin.
- Self-Loading** A type of firearm that, by pulling the trigger, utilizes the energy of recoil or the powder gases, together with a heavy counter-balanced bolt and strong bolt spring, to eject the fired case, load a fresh cartridge from the magazine into the chamber, and close the breech to the ready to fire position. The trigger must be pulled for each shot.
- Semiautomatic** Firearm that requires the trigger be pulled each time a shot is made.
- Shotgun** Smooth-bored gun; modern shotguns are loaded at the breech instead of through the muzzle.
- Side by Side** A double-barrel firearm with the barrels horizontally alongside of each other.
- Sight Radius** The distance between the front and rear sights. The longer the distance, the greater the accuracy.
- Single-Action Revolver** Pistol in which hammer must be pulled back after the trigger has been pulled before the pistol can be fired again.
- Single-Slotted Tip** Type of tip for cleaning firearms; holds the patch under all conditions.
- Smooth Bore** A firearm without rifling.
- Solder** Used to join sight ramps, sight bases, and other firearm accessories; use conventional 50 percent tin and 50 percent lead solder without an acid core.
- Sporter Stock** Most common type of rifle stock.
- Standing Breech** The face of the frame of a double-barrel shotgun that closes the barrels at the breech.
- Stock** Wooden member in which the lock and barrel are imbedded.
- Stock, Butt** The butt section of a firearm in which the forearm is separate from the butt stock.
- Stock, One Piece** The stock of a rifle in which the butt stock and fore end are in one piece.
- Take-Down Gun or Rifle** A firearm in which the barrel and adjacent parts can be separated from the receiver or action. This permits the weapon to be packed in a short container.
- Tang** One of the two arms or shanks of the frame or receiver of a gun that extends to the rear, and is inletted into the grip of the stock.
- Target Stocks** Area of the forearm and action is somewhat wider than on the sporting stock.

- Throat** The forward portion of the chamber where it tapers to meet the diameter of the bore proper.
- Tinning** The process of coating an area of a firearm by soft soldering.
- Tip-Up Action** Type of single-shot action in which the breech end of the barrel tips up and fires.
- Trigger** The small lever within the trigger guard. When pulled backwards, it releases the hammer or firing pin, which discharges the cartridge in the chamber.
- Trigger, Set** A type of trigger that can be set so that it will release the sear with a much lighter pull.
- Trigger Shoe** Evenly spreads trigger release pressure over the ball of the trigger finger.
- Trigger Guard** A guard surrounding the trigger of a firearm for protection and safety purposes.
- Twist** Amount of pitch in a rifle barrel's rifling; determines rate of spin a bullet will have when it leaves the end of the rifle barrel.
- Velocity** The speed of the bullet or shot charge, measured in feet per second at or near the muzzle.
- Ventilated Rib** A raised sighting plane fastened to a shotgun barrel by posts, allowing the passage of air to disperse the mirage rising from a hot barrel which distorts the shooter's view of the target.
- Water Table** The flat space on the underside of the barrels of a breakdown, double-barrel gun at the breech, which bed on or form the flat surfaces of the frame.
- Wool Mop Tips** Type of tip used for cleaning firearms; good for oiling the bores of rifles and shotguns; must be kept clean.
- Zero** The range in yards at which the sight of a rifle must be adjusted to center a group of shots at the point of aim from the same distance.

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## **ABOUT THE AUTHOR**

John Traister has been working with guns for years and now he brings his expertise to the beginner in **FIRST BOOK OF GUNSMITHING**. He is well qualified to write a book on the basics since he built his first pistol at the age of 13. His familiarity with guns began at an even earlier age when he fired a .22 rimfire at age 4.

Today he successfully combines two vocations—gunsmithing and writing about guns. He says that he can look out from his home office window while writing and spot customers looking for him in his gun shop. Combining two demanding occupations would be a tough job for anyone, but for John, it's a "dream come true."

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